

## 2. THE PROPOSED ACTION AND ALTERNATIVES

### 2.1 INTRODUCTION

The BLM identified a range of alternatives to the Proposed Action based on issues, concerns, and opportunities raised in public comments during scoping; interdisciplinary interaction between resource professionals; and collaboration with cooperating and other interested agencies. Comments on the Proposed Action received during the public scoping period are summarized in **Section 1.9, Public Participation**. A more detailed description of the public comments is found in **Appendix A: Summary of Scoping Comments by Category**. The alternatives to the Proposed Action that are examined in detail in this Final EIS include:

- Alternative B: Enhanced Resource Protection
- Alternative C: Surface Disturbance Cap—High and Low Density Development Areas
- Alternative D: Directional Drilling
- Alternative E: No Action
- Alternative F: Agency Preferred Alternative

Alternative A: 100-Percent Vertical Drilling was not carried forward from the Draft EIS to the Final EIS. Refer to **Section 2.3.3** for clarification on why this alternative was not carried forward.

The Proposed Action and the alternatives are described in this chapter, and the impacts are summarized in **Table 2.4-2** at the end of the chapter.

Although the development activities anticipated in the Proposed Action and in the alternatives would take place on federal, state, and private lands, BLM authority applies only to the activities that would occur on BLM-administered lands. Those activities on BLM-administered lands and mineral estate for the CD-C Natural Gas Development Project must conform to the Rawlins RMP. The Rawlins RMP was completed in December 2008 (BLM 2008b) and is available at <http://www.blm.gov/rmp/wy/rawlins/documents.html>.

### 2.2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

#### 2.2.1 The Proposed Action

BP America Production Company and other operators (the Operators) propose to drill up to 8,950 wells on approximately 1.1 million acres of federal, private, and state mineral estate, up to 500 of them coalbed methane (CBM) wells (**Map 1-1**). These wells would be in addition to the wells that have already been drilled in the CD-C project area—over 4,700 as of December 2013. The project, as defined by the Operators, is summarized here. For more detailed information, please refer to **Appendix B, Operators' Project Description**.

Under the Proposed Action, natural gas wells could be drilled either conventionally (with a single vertical well bore on each well pad) or with multiple directional well bores from a single pad. The development of shale oil through the use of horizontal drilling is not part of the Proposed Action and is therefore not analyzed in this document. It is anticipated that all wells would be drilled within 10 to 15 years following project approval. Although actual operations are subject to change, the Operators anticipate drilling at an average rate of 600 wells per year until the resource is fully developed. The Operators propose drilling infill wells at potentially up to 40 acres per down-hole well bore. The surface spacing of the wells would depend on the degree to which directional drilling is pursued. The Operators' proposal suggests an average spacing greater than 40 acres per well. Based on existing reservoir and well performance information, most gas wells would be completed in the Almond Formation (Mesaverde Group), although

secondary reserves may be encountered in other formations (e.g. Lewis, etc.). The average life of a well is expected to be 30 to 40 years for both conventional and CBM development. Combining well life with a 15-year construction period produces a potential project life of 45 to 55 years.

The Proposed Action would include the construction of 8,950 well bores from both single-well pads and well pads with multiple directional well bores. Although not stated in the Operators' Project Description, an examination of the disturbance numbers in the Project Description shows that approximately 42 percent of the 8,950 wells to be drilled would be located on multi-well pads and drilled to the target formation directionally; the other 58 percent would be located on single-well pads and drilled vertically. Each of the action alternatives attempts to increase the percentage of directional drilling on federal minerals and on public lands administered by the BLM. (**Section 4.0.3** has a more extended description of the analytical assumptions used in the EIS.)

Construction of a typical single-well pad would require approximately 6.3 acres, which includes 0.9 acre for an access road. A typical multi-well pad would disturb approximately 2.45 acres per well bore, which includes 0.45 acre for an access road. It is assumed that the average multi-well pad would have four well bores. Operators would determine the locations of new wells according to the subsurface reservoir, the topography of the area, and Wyoming Oil and Gas Conservation Commission (WOGCC) spacing rules. Dimensions of drill pads would depend on topography and specific well needs. **Table 2.4-1** shows the estimated surface disturbance for the Proposed Action and the alternatives.

The Operators anticipate that there would be up to 25 drill rigs in the project area at any one time in order to achieve the development objectives of the Proposed Action. Wells would be drilled utilizing conventional, mechanically powered mobile drilling rigs. Drilling each gas well would take from 7 to 10 days (6 to 14 days for CBM wells), with additional time likely for directional wells and wells deeper than 10,000 feet. The Operators propose to drill year-round, subject to BLM-required timing stipulations.

### 2.2.2 Alternative B: Enhanced Resource Protection

Environmental protection and mitigation of environmental impacts are integral to the BLM's management of natural resources on public lands. The RMP for the RFO mandates the implementation of protection measures, which vary by resource, prior to authorizing any surface disturbing and disruptive activities. Additionally, a number of SOPs and BMPs are implemented on a site-specific basis. These are described below and throughout the description of Alternative B as **Basic Protections**. The premise of the Enhanced Resource Protection Alternative is that intensive natural gas development may increase the risk of adverse impacts for some resources and thus those resources may require protections and mitigation beyond the Basic Protections required in the RMP. This alternative identifies the resources that may be more at risk from natural gas development and the **Enhanced Resource Protections** that would be implemented for these resources, which include enhanced protections and mitigation.

The alternative also recognizes that future development may be more intensive than currently expected or may have unintended consequences, resulting in impacts on wildlife habitats and populations in areas that were not anticipated or impacts that occur at a faster pace than anticipated. For that reason, the alternative describes disturbance and population thresholds that, if crossed, would signal the need for still more protections and mitigation. The thresholds are described below and throughout the alternative description as **Surface Disturbance Thresholds** and **Population Thresholds**.

The resources that would receive enhanced protection under this alternative are:

- Mule deer crucial winter (CW) and crucial winter/yearlong (CW/Y) ranges and migration corridors;
- Pronghorn antelope CW/Y range and migration corridors;
- Ferruginous hawk nesting habitat;
- The Muddy Creek and Bitter Creek corridors and watersheds;

- Chain Lakes alkaline wetland communities and other playas; and
- Livestock grazing.

Greater Sage-Grouse lek, nesting/brood-rearing habitat, and winter concentration areas were included in Alternative B in the draft EIS. Sage-Grouse habitat management prescriptions have been removed from the alternative in the final EIS because the BLM has determined that future management actions for Greater Sage-Grouse habitat within the CD-C project area will conform to the final Record of Decision for the Wyoming Greater Sage-Grouse Land Use Plan Amendment. That Land Use Plan (LUP) amendment is described in **Section 2.2.7.9, Management of Greater Sage-Grouse**.

### **Basic Protections**

Most of the above resources already have protective measures specified in the RMP or applied as SOPs. Such measures would apply to natural gas operations within the CD-C project area under all alternatives. These Basic Protections are described below in each section for the resources receiving enhanced protections as a reminder that these requirements apply at all times regardless of alternative. Other RMP measures are provided in detailed guidelines for resource management such as those found in Appendix 11 of the RMP – Water Quality and Watershed Management.

SOPs for resource protection can be found in COAs placed on an APD or in terms and conditions placed on a right-of-way grant (see **Appendix C**). In addition to items aimed at minimizing soil and water erosion and promoting successful reclamation, those measures may include such things as pre-disturbance surveys, consultation on facility location, signage, and constraints on traffic.

### **Enhanced Resource Protections**

Alternative B builds on the basic protections that are currently in effect in the project area, expanding the scale of some measures or adding new measures. Because several of these enhanced resource protections for the Muddy Creek watershed go beyond the scope of the current RMP, the selection of this alternative would require an RMP amendment to ensure those enhanced protection measures are in conformance with the RFO RMP.

A CD-C consultation and coordination group would be established that would respond to the need to develop mitigation plans and travel plans, and to resolve reclamation issues and other energy development-related issues as described in this Alternative. The group would be comprised of CD-C cooperators, local governments, conservation districts, landowners, and permittees.

APDs that would affect any of the described resources except livestock forage would be submitted with an overall development plan. The development plan would be submitted either for an individual lease or several leases. It should aim at reducing surface disturbance and disturbance associated with vehicle traffic and other human activity and should include, at a minimum:

- Consideration of consolidated development of production facilities;
- A road system that minimizes construction of new roads;
- Individual road design that minimizes surface disturbance while still meeting safe standards for the intended use;
- Reconstruction of access roads to a lower standard once drilling is completed and the operation phase has begun;
- Reclamation of all but one road once production starts if more than one road is built within the lease;
- A transportation management plan that minimizes vehicular traffic for monitoring and servicing wells and other facilities and that includes closures and/or time-of-day restrictions for production roads during the winter season;

- Consideration of site-specific pipelines for transporting liquids offsite or installation of larger-capacity storage tanks to reduce the number of truck trips to well sites; and
- A snow-removal plan to ensure protection of resources.

### **Surface Disturbance Thresholds**

This alternative includes surface disturbance thresholds for four of the six resources specified above: CW and CW/Y ranges and migration corridors, pronghorn antelope CW/Y range and migration corridors, ferruginous hawk nests, and livestock grazing. The surface disturbance thresholds would safeguard against additional unmitigated disturbance in areas that may have already had substantial disturbance. displays the degree of surface disturbance by section in the CD-C project area.

Generally, two threshold levels are specified:<sup>1</sup>

- A lower level, 5 percent of protected habitat within a lease and/or right-of-way, that signals a potential problem and mandates an evaluation of reclamation success. If reclamation success is limited, a revised plan would be required to address the failings. The initial level also calls for an assessment of the disturbance to determine if mitigation is needed.
- A higher threshold level, 10 percent of protected habitat within a lease, would require habitat improvement projects in addition to the above requirements.

Disturbance that is counted against the threshold includes all disturbance, both current and pre-existing, that is associated with natural gas access roads, pipelines, well pads, or other facilities that serve the Operator's lease and off-lease rights-of-way on adjacent BLM lands that also service the lease. Rights-of-way that cross a lease but service other Operators' leases would not count in the percentage calculation. The details of the surface disturbance thresholds for each of the five resources are described in the sections below. **Map 2-1** shows the level of existing disturbance by section within the CD-C project area.

### **Population Thresholds**

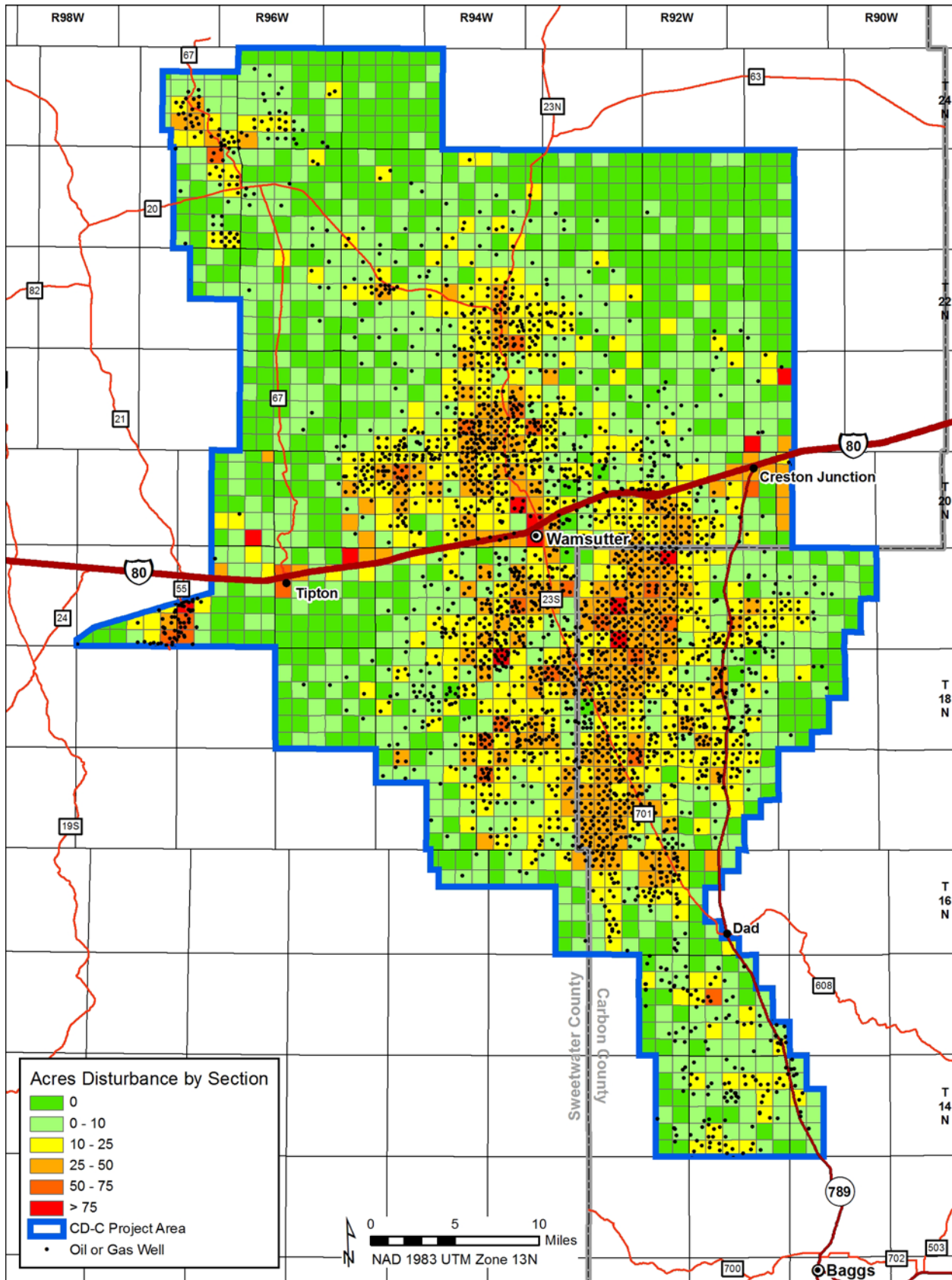
Additionally, there are population thresholds for three resources: mule deer CW/Y range and migration corridors; pronghorn antelope CW/Y range and migration corridors; and ferruginous hawk nests and potential nesting locations. If it were determined that a species population (based on information collected by the Monitoring Without Borders, the BLM, and the CD-C consultation and coordination group as detailed in **Appendix I: Wildlife Inventory, Monitoring, and Protection Plan**) within the project area were declining at an accelerated rate compared to the rest of the population due to natural gas development, a mitigation plan would be developed by the BLM and the CD-C consultation and coordination group. This mitigation plan would require:

- Evaluation of reclamation success and a request that the Operator provide a revised reclamation plan to address any failed reclamation.
- Implementation of BLM-approved habitat-improvement projects such as water developments or vegetation treatments. (The BLM may coordinate habitat improvement projects among multiple Operators.).
- Limitation of the number of well pads per section to maintain habitat effectiveness if consistent with valid existing rights.

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<sup>1</sup> The 5% and 10% thresholds rely on WGFD guidance on mitigating oil and gas development and its references to High and Extreme impacts on habitat (WGFD 2010a). High is generally referred to as 20-60 acres of disturbance within a section, and 5% is a proxy for that (640 acres X .05 = 32 acres); Extreme is 60 acres or more per section and 10% is a proxy for that (640 acres X .10 = 64 acres). Percentages have more utility than absolute figures when areas less than or larger than a section are under discussion.

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**Map 2-1. Existing surface disturbance by section, CD-C project area**

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

The preferred mitigation would be site- or area-specific. If a species' status were to change in the future, additional data, especially seasonal habitat use and condition data, would be collected and additional protective measures would be developed.

### 2.2.2.1 Pronghorn Antelope and Mule Deer

**Area of Concern:** Pronghorn Antelope CW/Y range and migration corridors (**Map 3.8-2**) and Mule Deer CW and CW/Y ranges and migration corridors (**Map 3.8-4**). Pronghorn CW/Y range and mule deer CW and CW/Y ranges are referred to collectively as crucial winter range (CWR).

#### Basic Protections:

- RMP Requirements
  - Seasonal restrictions on construction, drilling, and other activities from November 15 – April 30.
  - Disruptive activities within big game CWR would require the use of BMPs designed to reduce the amount of human presence and activity during the winter months (Appendix 15 of the ROD).
  - Surface-disturbing and disruptive activities would be managed on a case-by-case basis in identified big game migration and transitional ranges to maintain their integrity and function.
  - Fences identified to be a problem for big game migration would be modified to meet BLM fence standards. New fences would be allowed in big game migration corridors, provided they meet BLM fence standards.
- Standard site-specific requirements
  - Appendix 15 of the RMP includes other BMPs that can be considered to reduce impacts from gas development, some of which are included as requirements in this alternative (e.g., remote well monitoring).

#### Enhanced Resource Protections:

- Applications for Permit to Drill (APDs) within mule deer or pronghorn antelope CWR or CW/Y range and migration corridors would be submitted as part of an overall development plan for an entire lease or several leases. The plan is described above under the general requirements for the alternative.

In addition, the following requirements would be implemented throughout mule deer and pronghorn antelope CWR or CW/Y range and migration corridors:

- Man camps would be prohibited on BLM land;
- Noise-reduction technology, as approved and evaluated by the BLM, would be required at compressor stations; and
- Migration corridors would be monitored to determine which fences restrict movement and need to be modified to reduce impacts to migrating big game species.

#### Surface Disturbance Thresholds:

When surface disturbance for natural gas access roads, pipelines, well pads or other facilities exceeds 5 percent of pronghorn antelope or mule deer CWR and migration corridors within a lease, BLM would:

- Evaluate reclamation success in the lease and review, approve and oversee the implementation of an Operators' revised reclamation plan to ensure it addresses the reason for the failed reclamation. The calculated percentage disturbance would be adjusted downward for successful interim reclamation (**Appendix E**).
- Conduct an assessment of the disturbance and determine if enhancement of CWR is needed at this time.

If surface disturbance reached 10 percent of pronghorn or mule deer CWR and migration corridors in a lease, habitat improvement projects analyzed by a NEPA document such as an EA would be required in addition to the requirements above. The BLM would work with the CD-C consultation and coordination group and consult with them to determine which projects would be beneficial. These projects could include, but would not be limited to:

- Water developments for livestock and wildlife.
- Vegetation treatments such as herbicide treatments, seeding, prescribed burning, cutting/chopping for regeneration, planting shrubs or trees, fencing, establishing food plots, etc.

### **Population Thresholds:**

If it were determined by the BLM that any of the pronghorn or mule deer herds within the project area were declining at an accelerated rate, all new APDs on leases within mule deer and pronghorn antelope CWR in the CD-C project area would require an approved mitigation plan if the population decrease in those Herd Units were attributable in whole or in part to oil and gas development. The plan would be developed by the BLM and the CD-C consultation and coordination group and would include, but not be limited to:

- Evaluation of reclamation success in the lease and review, approve and oversee the implementation of an Operators' revised reclamation plan to ensure it addresses the reason for the failed reclamation.
- Implementation of BLM-approved habitat-improvement projects such as water developments or vegetation treatments. (BLM may coordinate habitat improvement projects among multiple Operators.)
- Limitation of the number of well pads on federal minerals or surface to no more than four per section within CWR to maintain habitat effectiveness, if consistent with valid existing rights.

If the population status of a species were to continue to decline in the future, additional data would be collected and additional protective measures would be developed.

### **2.2.2.2 Ferruginous Hawks**

**Area of Concern:** Nests and potential nesting substrate (**Map 3.8-8**)

#### **Basic Protections:**

- RMP Requirements:
  - No disturbance within 1,200 feet of a ferruginous hawk nest. The distances could vary depending on factors such as nest activity, species, natural topographic barriers and line-of-sight distances.
  - Seasonal restriction from April 1 – July 31 within 1 mile of a ferruginous hawk nest.
- Standard site-specific requirements:
  - Surveys of previous active ferruginous hawk nests to determine if they are in use that season. Lack of occupancy by a certain date could shorten the seasonal restriction.
  - If drilling activity within the seasonal distance restriction were started prior to the nesting period and a ferruginous hawk started utilizing a nest, additional mitigation as determined by the BLM could be required. This mitigation could include, but would not be limited to:
    - education sessions for employees regarding avoidance of the nest;
    - reducing speeds and being aware of foraging raptors;
    - utilization of alternate access routes to the well that are further away from the nest, etc.

### Enhanced Resource Protections:

No additional protections would apply to ferruginous hawk nests and potential nesting locations unless one of the thresholds described below were reached.

### Surface Disturbance Threshold:

Operators in all federal leases that exceed 10 percent of surface disturbance within 1 mile of ferruginous hawk nests would be required to participate in a development/mitigation plan before additional APDs would be issued.

### Population Thresholds:

If it were determined that the ferruginous hawk population was declining as a result of development, the following mitigation measures would be implemented immediately:

1. All existing development features and facilities (pads, pipelines, roads, holding yards, compressor stations, etc.) on federal minerals or on BLM surface within 1 mile of ferruginous hawk nests would be inspected to determine reclamation success. If reclamation has been unsuccessful, measures would be taken to improve the reclamation of the facilities.
2. Ten man-made<sup>1</sup> nests would be built outside of existing monitoring territories on natural substrates, and farther than 1,200 feet from existing disturbances, prior to January 10 of the following year
  - a. The farther the nest is constructed from existing disturbances the better; nest placement would take into consideration potential conflicts with Sage-Grouse seasonal habitat use of the area.
  - b. These nests would be incorporated into the annual monitoring efforts.
  - c. Should the nests become occupied by raptors, avoidance or seasonal COAs would be applied to APDs or right-of-way grants for disturbances in the vicinity of the nests.
3. Two artificial nesting structures<sup>2</sup> would be placed outside of existing monitoring territories, and farther than 1,200 feet from existing disturbances, prior to January 10 of the following year.
  - a. Priority for placement of these nests would be determined based on information regarding extant nests located on man-made infrastructure, or where there are known repeated attempts at nesting on man-made infrastructure; nest placement would take into consideration potential conflicts with Sage-Grouse seasonal habitat use of the area.
  - b. These nests would be incorporated into the annual monitoring efforts.
  - c. Should the nests become occupied by raptors, avoidance or seasonal COAs would be applied to APDs or right-of-way grants for disturbances in the vicinity of the nests.

The above mitigation measures would be applied and installed on a site-specific basis, at which time the method of apportioning costs would be identified if multiple operators are involved. If the species population continues to decline, additional data would be collected and additional protection measures would be developed by the BLM and the CD-C consultation and coordination group.

### 2.2.2.3 Muddy Creek and Bitter Creek Corridors/Watersheds

**Area of Concern:** The Muddy Creek and Bitter Creek watersheds for water quality (salinity, selenium, and 303(d) listed waters), aquatic physical habitats, and sensitive fish habitat (**Map 3.9-5**).

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<sup>1</sup> Man-made nests are nests that are built in appropriate habitat and are intended to attract ferruginous hawks. Any proposed man-made nests would be developed on a site-specific basis and consideration would be given to potential impacts on other resources, such as Greater Sage-Grouse.

<sup>2</sup> Artificial nesting structures are built to attract hawks that would build their own nest on the structure.

### Basic Protections:

- RMP Requirements:
  - For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 500 feet of perennial waters, springs, wells and wetlands, and areas within 100 feet of the inner gorge of ephemeral channels.
  - Design of road crossings of water bodies that potentially support fish for a portion of the year to simulate natural stream processes.
  - Design of impoundments and instream structures to minimize impacts on Special Status fish species and their habitats.
  - Intensive management of surface-disturbing activities within those portions of the Muddy Creek drainage that contribute to degradation of reaches previously or currently on the 303d list.
  - All basic watershed protections in Section 2.3.16, Water Quality, Watershed, and Soils Management, and Appendix 13, Reducing Nonpoint Source Pollution with BMPs, of the RMP ROD.
- Standard site-specific requirements:
  - Maintenance of existing roads to ensure they are not contributing sediment to Muddy Creek or adjacent wetlands.
  - Appendices 13 and 15 of the RMP include several BMPs that can be considered to reduce impacts from gas development, a number of which are included as requirements in this alternative.

### Enhanced Resource Protections:

- For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 0.25 mile of Red Wash, springs, wells, and wetlands. The required avoidance distance would be further increased on perennial streams (such as Muddy Creek) to 0.5 mile. Exceptions would only be granted by the BLM based on environmental analysis and site-specific engineering and mitigation plans. Only actions within areas that could not be avoided and that would provide protection for the resource identified would be approved. In-channel activities would be restricted to the low-flow period.
- Current geomorphic and water quality monitoring on upper Muddy Creek would be extended to Lower Muddy Creek in the CD-C area, in concert with existing conservation district plans. If results of the monitoring program showed impacts to sensitive fish habitat as a result of natural gas development, the BLM and the CD-C consultation and coordination group would determine whether habitat-improvement projects should be implemented. The projects could include, but would not be limited to: increasing the number of drainage features along roads, increasing in-stream cover for fish, and others.
- A monitoring plan for the portion of the Bitter Creek watershed within the CD-C project area will be designed by the RFO in coordination with the Rock Springs Field Office and the Sweetwater County Conservation District.
- A risk level analysis will be conducted for the Muddy Creek and Bitter Creek watersheds using the existing Rosgen 2008 WARSS process and data to determine the risk of additional sedimentation. This will permit identification of areas of high erosion potential.

Plans for development within the entire Muddy Creek and Bitter Creek watersheds would be required and should include, at a minimum, the following additional road/pipeline requirements:

- Detailed development, transportation, and reclamation plans, including road design, culvert placement, steep slopes, etc.;

- Design of improvements to existing roads or construction of new roads to minimize hydrologic alteration;
- No new road crossings of Muddy Creek;
- Boring of all pipeline crossings of riparian areas;
- Development of specific road design criteria based upon site-specific review and likely including a combination of mitigation options; and
- Submission of data from inspections of erosion control BMPs within the Muddy Creek and Bitter Creek watersheds would be required. The format and frequency of submission of these data would be coordinated with the BLM and could use the same information collected under the Stormwater Pollution Prevention Plan or other BLM-approved monitoring method.

### 2.2.2.4 Chain Lakes Alkaline Wetland Communities and Other Playas

**Area of Concern:** Chain Lakes Alkaline Wetlands and other playas

**Basic Protections:**

- RMP Requirements – For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 500 feet of perennial waters, springs, wells, and wetlands (defined here as 500 feet from the ordinary high water mark of the playa).
- Standard site-specific requirements – None

**Enhanced Resource Protections:**

- A transportation and development plan to avoid the alkaline wetland communities at Chain Lakes.
- Avoidance of surface-disturbing and disruptive activities within 0.25 mile of any Chain Lakes alkaline wetland community or the ordinary high water mark of other playas.

### 2.2.2.5 Livestock Grazing

**Area of Concern:** Public land grazing allotments (**Map 3.18-1**)

**Basic Protections:**

- RMP Requirements – Wyoming Standards and Guidelines for Rangeland Health.
- Standard site-specific requirements – Immediate repair of any damages to existing range improvements, fences, cattle guards, gates, etc. caused by natural gas operations, with such repairs to be made by the natural gas Operators in consultation with the grazing permittee.

**Enhanced Resource Protections:**

- If a causal link is identified between natural gas development in an area and adverse effects on water wells, springs, or surface water improvements used for the benefit of livestock, those effects would be remediated as appropriate or mitigated by new water well development
- Annual meetings conducted by BLM with Operators and grazing permittees to discuss project-specific impacts and required mitigation. Natural gas Operators would present their proposed drilling and maintenance schedules during these meetings to identify potential conflicts and address any unforeseen impacts.
- Thorough power-washing by Operators of all field vehicles—particularly their undercarriages—before entering the project area or when moving from one part of the project area to another.
- During the production phase, as well as the construction phase, control by Operators of fugitive dust on well sites, pipelines, and access roads as needed.

### Surface Disturbance Thresholds:

If the surface disturbance due to natural gas development were to reach 5 percent of an allotment, several actions would be triggered (in this and later calculations, surface disturbance is used as a surrogate for available forage):

- A review of reclamation success in the allotment. If reclamation efforts had not achieved the required standards, Operators would be required to submit a revised reclamation plan for achieving reclamation success and begin implementing that plan.
- Planning for future natural gas development to avoid critical grazing areas (i.e. calving grounds, trailing routes, and identified summer and winter grounds), range improvements, and other important livestock areas.
- If planning were to identify the need for rangeland improvement projects, BLM would begin planning such projects in consultation with the grazing permittee and the Operators, and may begin implementing the projects, as warranted. Rangeland improvement projects with allotment-wide benefits could involve participation of all Operators within the allotment.

If the amount of unreclaimed surface disturbance due to natural gas development were to reach 8 percent of an allotment, the BLM would require that mitigation be implemented to avoid reaching the designated RMP significance criterion of a permanent 10-percent reduction in AUMs available for livestock grazing within the allotment. The type of mitigation would be determined by the BLM in concert with the grazing permittee and could include, but would not be limited to, the following:

- Construction of temporary fencing when necessary in order to protect reseeded areas and other fragile areas.
- Construction of temporary or permanent fences to create pastures to improve livestock distribution and/or minimize livestock and vehicle collisions (all fences would comply with BLM fence construction regulations).
- Water development projects to distribute livestock, when consistent with the RMP.
- Vegetation treatment projects to increase and improve forage for livestock.

**Table 2.4-1** shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

### 2.2.3 Alternative C: Surface Disturbance Cap—High and Low Density Development Areas

This alternative designates parts of the project area as high-density development areas—those areas that have seen the greatest natural gas development to date (**Map 2-2**). Within the high-density development areas, a 60-acre cap would be placed on the amount of unreclaimed surface disturbance at any one time in a section of public land or federal mineral estate. For the remainder of the project area—the low-density development areas—the cap would be 30 acres per section. The 60-acre cap represents the disturbance associated with a 9-well per section drilling program (80-acre spacing) that would have been achieved with vertical wells only, a typical historic pattern of development in the high-density area; a 30-acre cap represents the disturbance associated with a 16-well per section drilling program (40-acre spacing) that could be achieved with directional drilling.

All prior surface disturbance committed to long-term use for natural gas development roads or on-pad production facilities and all disturbance that had not been successfully reclaimed would count against the cap. Acreage that had achieved successful interim reclamation would not count against the cap. For example, within a high-density development area, a section that had seen 40 acres of historical disturbance for natural gas development would start the development period with a reduced cap of 20 acres (60 acres less 40). Once interim reclamation on the development was determined to be successful,

the acreage reclaimed could be *rolled over*, meaning counted again as undisturbed acreage, and the cap would be increased by the amount of successful interim reclamation. If, for example, 24 acres of interim reclamation were judged to meet the interim reclamation standard, it would be *rolled over* and the cap for that section would increase to 44 acres (20 acres plus 24). Only the 16 acres used for roads and production facilities would continue to count against the cap.

If there had been no natural gas development in a section within the high-density development area, the Operator would be able to develop the natural gas resources of that section until surface disturbance from well pad, access road, and pipeline construction reached 60 acres. At that point, no further disturbance could take place until disturbed acreage had achieved successful interim reclamation. Outside the high-density development areas, the same conditions and the same process would apply, but the cap would be set at 30 acres.

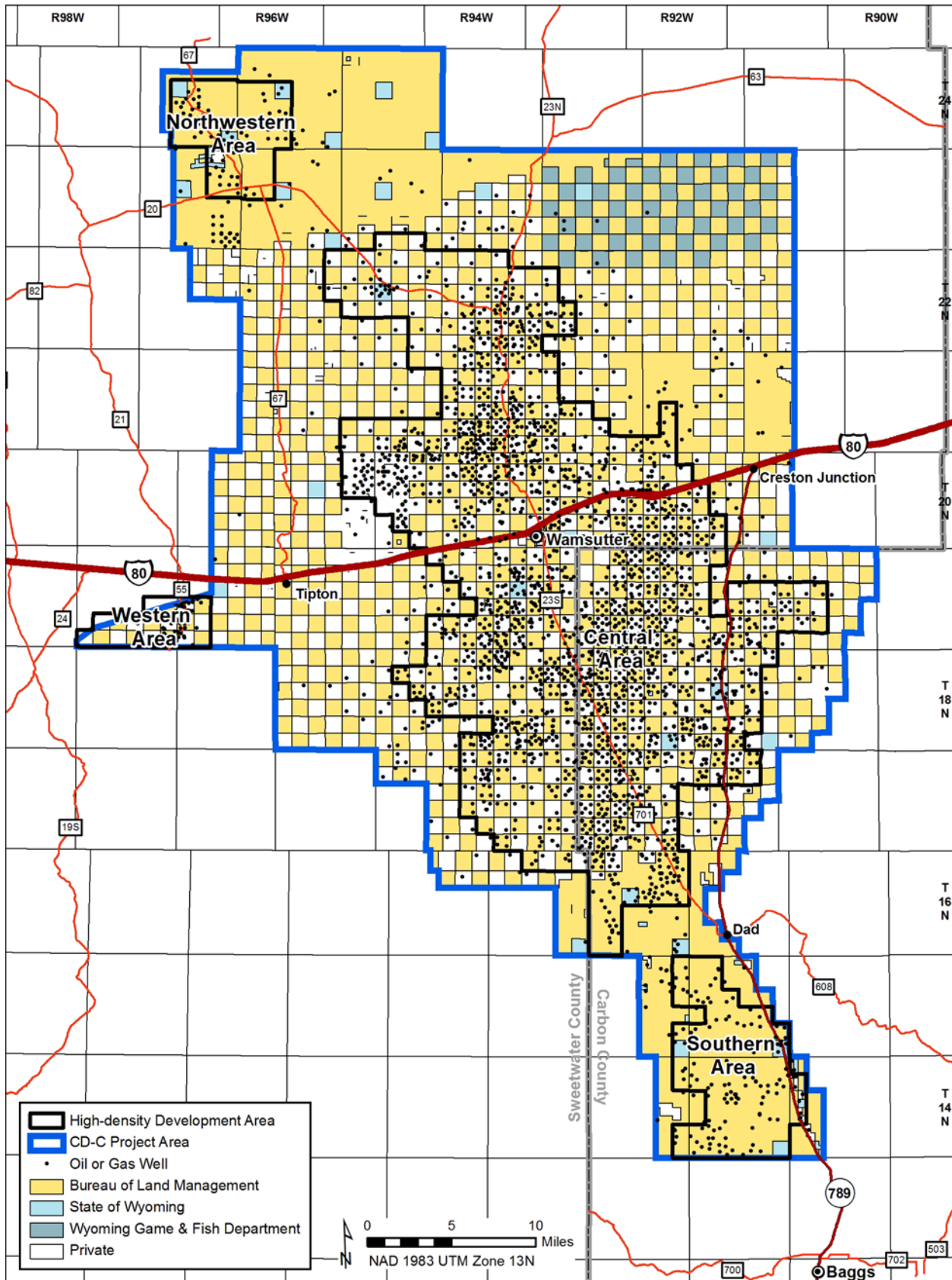
**Map 2-2** shows the high-density development and low-density development areas within the project area. Of the 1,697 sections within the project area, 744 sections (about 44 percent) are within a high-density development area. Average historic surface disturbance within the high-density development areas is 32.9 acres per section. The average number of wells per section is 5.1. The remaining 953 sections (about 56 percent) are within low-density areas. The average disturbance in those areas is 4.5 acres per section; the average number of wells per section is 0.7. Included in the low density areas are 400 sections that have had no development to date.

All public lands in the project area would be subject to the cap. Disturbance on private and state lands would not count against the cap. The Operators would be required to update their reported disturbance annually in order to certify the accumulated disturbance on their federal lease holdings to date and the amount of interim reclamation that had occurred. Under the alternative, the BLM would perform quality control on the reported data and evaluate the reported interim reclamation and the success of that reclamation. The BLM would then calculate net available surface disturbance under the cap for each section. As new drilling proposals were received, they would be evaluated against the net available surface disturbance within the section where the drilling was proposed. For oil and gas leases smaller than a section, the acreage cap would be adjusted on a pro-rata basis.

All pre-existing and current surface disturbance on-lease associated with natural gas well pads, their access roads, and gathering pipelines would count against the cap. Major natural gas processing and transmission facilities would not count against the cap. In addition, federal, state, county, and local roads and highways, railroads, and disturbances created by private landowners, including homesteads and ranching operations would not count against the cap.

A central element of this alternative is the standard used to determine if interim reclamation efforts have been successful and if the reclaimed acreage can be rolled over. The standards to be met for successful interim reclamation of surface disturbance on public lands are described in **Appendix M: Interim Rollover Objective (IRO) for Alternative C**, which includes two documents that apply to interim reclamation and the concept of rollover: the Proposed IRO for the CD-C Natural Gas Project and the CD-C Rollover Criteria. These two documents would guide the evaluation of reclamation under the Alternative C surface cap and set the standard for potential rollover of acreage that had undergone interim reclamation. The IRO document provides guidance for how best to achieve interim reclamation that can then be rolled over. The CD-C Rollover Criteria document lays out the standard that must be met if disturbed acreage is to be classified as successful interim reclamation. Disturbed acreage that met the objectives could then be deducted from the number of acres counted as surface disturbance—that is, rolled over.

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**Map 2-2. High-density and low-density natural gas development areas, CD-C project area**

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

The interim rollover objective (IRO) described in **Appendix M** was developed during the preparation of the EIS by the State of Wyoming, local governments, the University of Wyoming, participating leaseholders, several CD-C operators, and the BLM. The purpose of the IRO is to identify when reconstruction and re-vegetation activities on disturbed lands are adequate for rollover credit. The objectives are to: establish vegetation cover sufficient to maintain a healthy, biologically active topsoil; control erosion; minimize loss of habitat, forage, and visual resources during the period of the disturbance; and control invasive non-native weeds.

The specific reclamation success standards for the IRO are as follows:

- The area is revegetated with a stable, approved plant community.
- Vegetative cover is sufficient to maintain a healthy, biologically active topsoil.
- Erosion is controlled.
- Habitat, visual, and forage loss is minimized.
- No noxious weeds are present.

### 2.2.4 Alternative D: Directional Drilling

This alternative requires that all future natural gas wells on federal mineral estate be drilled from existing or new multi-well pads, which would require the employment of directional drilling technology, subject to valid existing rights. One new multi-well pad per section (or per lease if the lease area is less than a section) would be permitted. In sections that have already had oil and gas development, the enlargement of one existing well pad would be permitted as the multi-well pad for all future drilling in that section. No new roads or pipeline routes on a lease would be permitted. Proposals for access across federal lands for oil and gas development on adjacent private and state parcels would still be considered as appropriate by the BLM.

In sections that have not had oil and gas development at all, only one new well pad would be permitted for all future development in each section. One road and pipeline corridor per well would be permitted. Proposals for access across federal lands for oil and gas development on adjacent private and state parcels would still be considered as appropriate by the BLM. No numerical disturbance caps, no rollover credits, and no additional requirements on reclamation are part of this alternative.

The objective of this alternative is to minimize surface disturbance and to reduce habitat loss and wildlife disruption. A reduction in the number of well pads and associated roads, pipelines, and other facilities would result in less surface disturbance and thus reduce the amount of habitat directly lost. In addition, multiple-well pads would be distributed less densely than single-well well pads, reducing the habitat fragmentation and ongoing disturbance created by the network of well-pad access roads.

Operators may request that an APD be excepted from the general rule. Examples of the types of exceptions that would be considered include, but are not limited to:

- In sections that have already had some level of development, Operators may request that more than one existing well pad be used as a multi-well pad. The Operator must establish that the drilling objective cannot be achieved from any single well pad. In general, such requests would be considered by BLM after one single-well pad had been enlarged and efforts had been made to develop the entire section.
- In sections that have not had prior development, Operators may request that more than one multi-well pad be constructed. The Operator must establish that the drilling objective cannot be achieved from a single-well pad. In general, such requests would be considered by BLM after one multi-well pad had been constructed and efforts had been made to develop the entire section.
- Operators may request that road and pipeline routes be relocated. The request should demonstrate how the relocation would reduce vehicle traffic and increase the efficiency of product transportation.

It is expected that exception requests would largely be based on difficult surface conditions, topography, subsurface geology, or fluid mineral resource characteristics that would make it impossible to maximize the recovery of the gas resource in a lease. Specific exception criteria are not included here due to the changeable nature of natural gas drilling technology. CBM proposals could be considered in the exception category. Requests based on the need to produce in the most economic and efficient manner would be considered.

**Table 2.4-1** shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

### 2.2.5 Alternative E: No Action

A No Action Alternative must be considered in all NEPA documents as required by 40 Code of Federal Regulations [CFR] 1502.14(d). Under the No Action Alternative, the BLM would deny the Proposed Action and Action Alternatives for natural gas development on federal lands in the CD-C project area. Denial of the current proposal would not be a denial of all natural gas development in the area, however. Due to the intermingling of federal, state, and private lands within the CD-C project area, it is reasonable to assume that subsequent development proposals would be received for access to state and private lands for mineral development. In addition, individual proposals for exploration or development of federal minerals including APDs, rights-of-way, and access across federal lands could still be received and would be subject to site-specific analysis prior to approval or authorization. Existing lease rights on federal minerals would still be recognized and development of those leases would be authorized on a site-specific basis.

The No Action alternative allows for a comparison of the impacts of the proposed development versus that of rejecting the Proposed Action and action alternatives.

For the purposes of this analysis, it is assumed that development of the portion of the Proposed Action that involves private and state fluid mineral leases, an estimated 485,819 acres (45.4 percent) of the project area, would take place, as the BLM does not have jurisdiction over private and state fluid minerals. The No Action Alternative assumes that development of private and state minerals would proceed under the same conditions as the Proposed Action, resulting in an estimated 4,063 wells on 2,783 well pads. The rate of drilling over the 15-year development period would decrease from 600 wells per year to 270 wells per year.

An estimate of the potential case-by-case development on federal lands was not calculated, because this estimate would be highly speculative. Therefore, for the No Action analysis, disturbance and development on federal mineral leases would be assumed to occur, but is not included in the acreage discussed in the impact analysis.

Several other assumptions were made in analyzing the impacts associated with the No Action Alternative:

- Split estate (BLM surface with fee/state minerals) would be developed;
- Impacts associated with development on fee/state minerals would be proportional to the Proposed Action impacts, as described in **Table 4.0-1**; wells drilled would be 45.4 percent of 8,950, or 4,063; initial surface disturbance related to drilling would be 45.4 percent of 41,889 acres or 19,028 acres; well pads would be 2,783, 45.4 percent of 6,126;
- The Operator's commitment to use tier 2 engines on drilling rigs would apply; and
- Standard regulations, requirements, and BMPs enforced by the State of Wyoming and other federal agencies would apply.

**Table 2.4-1** shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

### 2.2.6 Alternative F: Agency Preferred Alternative

Alternative F, the Agency Preferred Alternative, was developed in response to comments received during the Draft EIS public comment period that indicated that the alternatives analyzed in the draft did not individually fully respond to issues identified during scoping. It is designed to incorporate directional drilling to reduce surface impacts while still allowing for resource recovery, and aims to reduce impacts to specific resources identified during scoping and the Draft EIS public comment period. The addition of this alternative does not introduce significant new information, and elements within this alternative were analyzed in the Draft EIS. Therefore, the introduction of this alternative does not require the preparation of a supplemental EIS (40 CFR 1502.9 (c)).

Under Alternative F, the Operators would drill up to 8,950 natural gas wells and construct associated infrastructure and ancillary facilities. Please see **Appendix B** and **Section 2.2.7 Features Common to All Alternatives** for detailed information on project development.

The following have been incorporated as part of this alternative:

Water and soil management to reduce fugitive dust and impacts to air and water resources: Specific issues identified include salt and sediment contributions to the Muddy Creek and Bitter Creek watersheds as tributaries to the Colorado River (**Map 2-3**), which can cause detrimental impacts to sensitive fish species and general water quality. BLM-authorized federal lease operations including well pads, access roads, pipelines, and ancillary facilities located within ½ mile of Muddy Creek, Red Wash, and/or Bitter Creek, and within a ¼ mile of playas within the Chain Lakes WHMA, would be subject to the following surface use COAs:

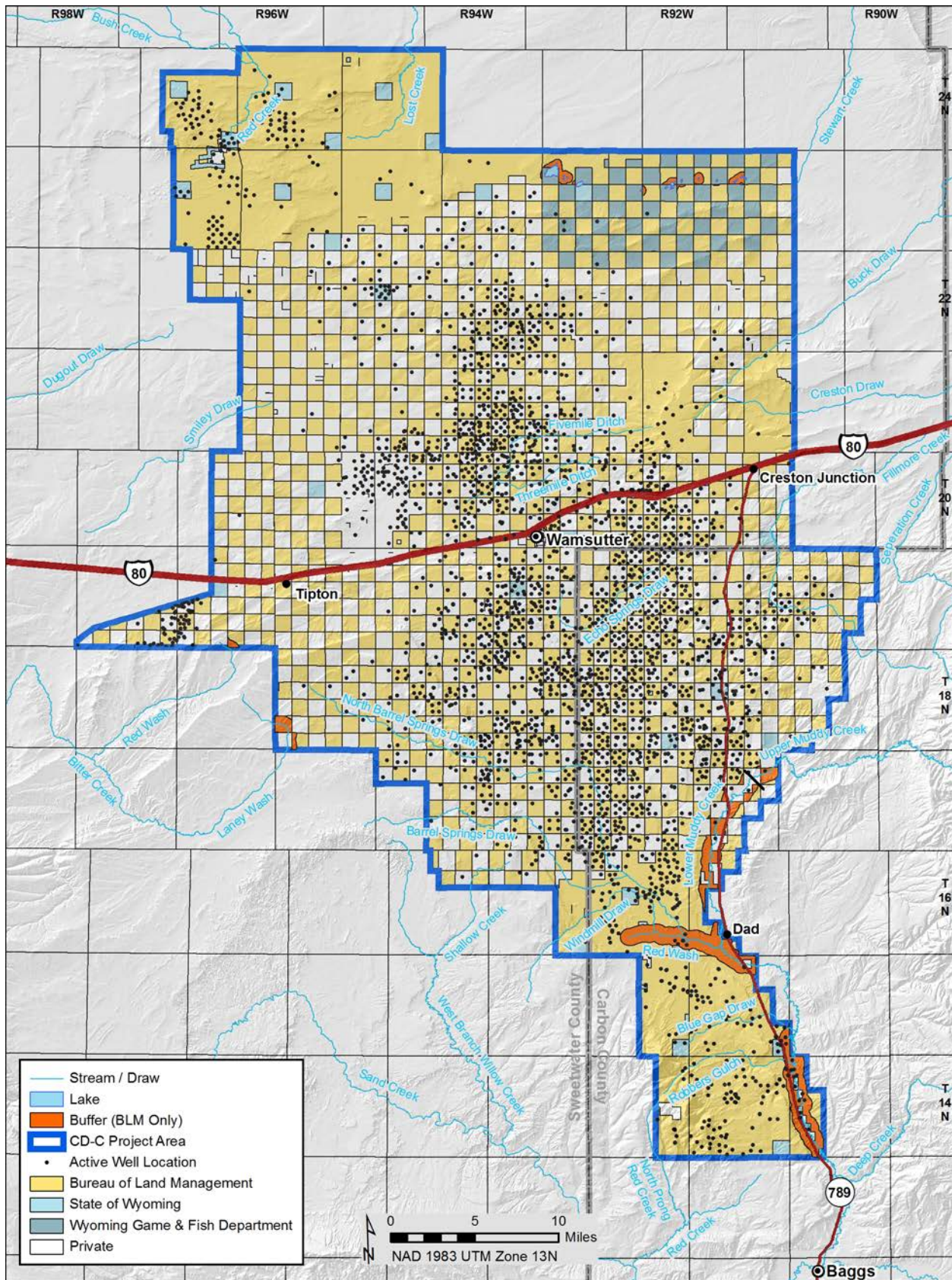
- Submission of bi-annual stormwater Best Management Practice (BMP) monitoring data collected by the Operators to the BLM. The data would include BMP type, condition, and maintenance needed (if any). Inspection reports would include, at a minimum, an electronic map depicting locations of BMPs and electronic spreadsheets describing the status, and if necessary, proposed maintenance or replacement of degraded or non-functioning BMPs. If a 20-percent overall BMP failure rate or a 5-percent recurring failure rate of individual BMPs is observed, corrective measures would be implemented, which would include additional site-specific BMPs, immediate corrective actions, and other measures to ensure BMPs are successful. A failed BMP is defined as one that is no longer effective in retaining sediment or serving the purpose it was designed to achieve. **Appendix R** details data submission guidelines;
- Boring of all pipeline crossings of perennial drainages and riparian areas identified on a site-specific basis;
- Soil stabilization of all disturbances within 30 days of well completion;
- Closed or semi-closed loop drilling would be required.

In addition, closed-loop drilling would be required within ¼ mile of Muddy Creek, Red Wash, Bitter Creek, and playas within the Chain Lakes WHMA.

Additional site-specific measures may be developed during the onsite. Exceptions or modifications to the above stated measures may be granted on a site-specific basis and would generally be dependent on the geology of the area, weather, and/or wildlife. A monitoring plan for Muddy Creek and Bitter Creek (**Appendix O**) has been developed and would be implemented by the BLM.

A CD-C discussion group would be formed that would respond to evolving energy issues; respond to cooperator, local government, or landowner concerns related to the CD-C project; and discuss opportunities for off-site and regional mitigation. The group would not be a decision making organization, but rather, would be responsible for information sharing pertaining to wildlife monitoring, watershed monitoring, BMP submission data, and the development of off-site and regional mitigation projects, including habitat improvements when necessary. This group would consist of the BLM, CD-C cooperators (state agencies, local governments, and conservation districts), local landowners, and

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**Map 2-3. Preferred Alternative: Muddy Creek, Red Wash, Bitter Creek, and Chain Lakes Playas Buffers**

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

permittees. The group would participate in a yearly site visit of the project area. Ideas and information shared at these meetings could be used by the BLM to implement adaptive management, in accordance with the U.S. Department of Interior Adaptive Management Guidelines (USDI 2009) if and when necessary, to improve management of the area and mitigate impacts to sensitive resources.

Minimize surface disturbance to reduce impacts to vegetation, range, wildlife, and wild horse resources: Specific issues identified include: big game habitat fragmentation, reduced forage, and reduced forage palatability as a result of increased surface disturbance and dust. Analysis of previously authorized natural gas development projects in the area (CDWII, CBG) was based on no more than eight well pads per square mile. Due to concerns related to the increase in surface disturbance that would be a result of the Proposed Action:

- This alternative would limit the Operators to no more than eight well pads per square mile on BLM-administered lands to minimize surface disturbance and encourage directional drilling;
- Exceptions could be granted on a case-by-case basis (e.g. to be consistent with existing lease rights and the RMP) and the Operator must establish that the drilling objective would not be achievable without the construction of additional well pads in areas already having eight well pads per square mile;
- The expansion of individual well pads in areas already exceeding eight well pads per square mile would only be authorized on a site-specific basis;
- Transportation planning would be implemented as outlined in **Appendix N, Transportation Plan**;
- Road and pipeline networks and well pads would be sited to avoid, to the extent practicable, sensitive wildlife habitat such as big game winter range and/or migration corridors to reduce fragmentation and minimize disturbance

The fugitive dust control plan (**Appendix P**) would be adhered to by the Operators in conjunction with the BLM, and dust control measures would be applied during all phases of the well's life cycle in specific areas and during specific times as indicated in the dust control plan and the COAs for the APD.

**Table 2.4-1** shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

### 2.2.7 Features Common to All Alternatives

The following project-wide development specifications would apply to the Proposed Action and all alternatives. The information in this section is available in more detail in **Appendix B, Project Description**.

Factors outside of the Operators' control, including geologic characteristics, reservoir quality, engineering technology, and economic conditions could affect the Operators' ability to adequately drain the reservoir and could result in fewer than 8,950 wells being drilled. Across all alternatives, valid existing lease rights would be honored.

Under all alternatives, all federal lease terms, RMP requirements, and federal, state, and local laws, rules, and regulations would be adhered to on federal surface and mineral estate. Site-specific NEPA-mandated environmental analysis would be prepared for all proposed wells, pipelines, road, and ancillary facilities on federal surface and mineral estate, prior to any surface disturbance. Approval by the BLM of an APD, right-of-way grant, or sundry notice would be required prior to the initiation of any surface disturbing activity. All Conditions of Approval (COAs), Terms and Conditions (T&Cs), and SOPs as required by the BLM would be adhered to on a site-specific basis. BMPs, COAs, and T&Cs are presented in more detail in **Appendix C**.

The facilities required by the project would include: roads; gathering pipelines for gas, water, and condensate; overhead and buried power lines; production facilities (separation, metering, treating, fluid

storage, compression, artificial lift, etc.); disposal well and/or evaporative ponds; equipment storage facilities; and other associated facilities. In general, gas would be transported via subsurface pipelines to centralized compression and treatment facilities, although some well-site compression may be included on an as-needed basis. Produced water would be transported by truck to water-disposal wells or evaporation ponds, or by pipeline to treatment facilities. Existing arterial roads would provide the main access to and within the project area.

### 2.2.7.1 Road Construction Activities

As this project would consist of infill development in an existing natural gas field, new road construction would not be extensive. The primary access to the project area is I-80. Existing arterial roads, including Wyoming State Highway (WY) 789 and several Sweetwater and Carbon county roads, provide access within the project area. New road construction would primarily be short sections of road from the existing road network to new well sites and support facilities. Existing access roads may need to be improved to accommodate increased traffic. Specific locations for access roads are not known at this time but would be included in site-specific permit applications and would be evaluated by the BLM during onsite inspections.

### 2.2.7.2 Well Construction, Drilling, and Completion Activities

The **Operators' Project Description, Appendix B**, estimates that construction of a typical single-well pad would result in the disturbance of approximately 6.3 acres, which includes 0.9 acres for an access road; a typical multiple-well pad would disturb approximately 2.45 acres per well bore, including 0.45 acres for an access road. The Operators based their numbers on an evaluation of oil and gas surface disturbance in the RFO prepared by the BLM in 2005 (Bargsten 2005). Locations of new wells would be determined according to the subsurface reservoir, the surface topography, site-specific environmental impacts analyzed by the BLM, and WOGCC spacing rules. Dimensions of well pads would depend on site-specific topography and other environmental requirements.

The Operators anticipate that the drilling-rig count within the project area would be up to 25 rigs at any particular time in order to achieve development objectives. Wells would be drilled utilizing conventional, mechanically powered mobile drilling rigs. Drilling each gas well would take from 7 to 20 days (6 to 14 days for CBM wells), with additional time likely for directional wells and wells deeper than 10,000 feet. The Operators propose to drill year-round subject to environmental considerations.

Approximately 20,000 to 30,000 barrels (bbls) of water would be needed to perform drilling operations for both gas and CBM wells. Fresh water would be used for drilling the first 5,000 to 7,000 feet of each gas well (500 to 1,000 feet for each CBM well), and water-based muds would be used for the remainder of the drilling operation. Water would come from existing and new water-supply wells within the project area, as well as from produced-water sources. The use of produced water to the greatest extent possible would conserve fresh-water aquifers. No water would be withdrawn from surface waters of the project area.

Usable water zones would be protected by implementation of the BLM's Onshore Oil and Gas Order No. 2. That order defines "usable water" as groundwater with total dissolved solids of 10,000 parts per million or less encountered at any depth. This definition of usable water corresponds to the EPA's definition of an Underground Source of Drinking Water (USDW). To comply with the order, wells must be constructed and/or installed using state-of-the-art techniques, such as cementing and other proven technologies, such that usable water and unusable water do not mix. Compliance with this order would insure that no contamination of usable groundwater would occur. On November 12, 2013 the WOGCC adopted a rule change (Chapter 3, Section 46) requiring groundwater monitoring of water sources within a 0.5-mile radius of a proposed gas well. Effective April 1, 2014, all operators are required to submit a groundwater baseline sampling, analysis, and monitoring plan with an APD (WOGCC 2014a).

A fenced reserve pit, approximately 10 to 12 feet deep, would be excavated within the pad to temporarily store drilling fluids and cuttings. All pits would be lined (using a synthetic liner with a minimum thickness of 12 mm or clay liner) with the exception of flare pits; and situations where only fresh water, cement, and nontoxic or nonhazardous muds and additives are being used for drilling, completion, and plugging activities. Reserve pits would be constructed so as minimize the potential to leak, break, or allow discharge and in accordance with APD COAs. The reserve pit would be fenced on three sides during drilling operations and on the fourth side when the rig moves off the location. The reserve pit would be reclaimed per the requirements specified in the approved APD. Reserve pits may be re-used for multiple wells being drilled from a single pad. The use of closed-loop or semi-closed loop drilling systems that allow for reuse of drilling fluid and reduce the need for a reserve pit may be implemented.

BLM Wyoming Instruction Memorandum (IM) WY-2012-007, Management of Oil and Gas Exploration and Production Pits (BLM 2012k), provides the minimum standards for management of pits authorized by the BLM on Federal/Indian oil and gas leases for exploration and production activities. Pits associated with oil and gas activities should be considered to contain potentially hazardous wastes harmful to human health. Per the IM, the RFO is required to consider and evaluate the standards in the IM when approving actions that pertain to construction, use, maintenance, closure, and reclamation of oil and gas exploration and production pits.

Drilling operations require approximately 8 to 10 personnel and six vehicles on location at any given time each day during normal operations. An additional 10 to 15 personnel and six vehicles would be required on location during the running and cementing of the production casing. A cementing plan is submitted with the drilling plan as part of the APD. This plan is reviewed by the BLM and/or the WOGCC.

Completion operations would begin once production casing is cemented in place. In general, completion consists of perforating the production casing, pressure testing, stimulation of the formation utilizing hydraulic fracturing technology, flow-back of fracturing fluids, flow testing to determine post-fracture productivity, and installation of production equipment to facilitate hydrocarbon sales.

Hydraulic fracture stimulation is performed on the majority of wells in the project area during completion operations in order to enhance productivity. Combinations of fluids and proppants are injected into the well bore through the perforations in the casing, and into the formation to optimize stimulation. One common stimulation technique utilizes gelled fresh water (with carbon dioxide and/or nitrogen frequently added for reservoir protection and enhanced flowback) and fracture proppants to provide bridging and increased permeability. Sand, resin-coated sand, ceramics, or bauxite can be used as proppants. Gels and other chemical additives provide fluid viscosity. Sufficient rates and pressures are reached to induce a fracture in the target formation. The proppant carried in the fluid serves as a bridge to keep the created fracture open and to provide a flow path that allows reservoir fluids to move more readily into the well bore. Water used for stimulation purposes generally comes from water supply wells. Stimulation fluids recovered during flow back and subsequent production operations are temporarily contained in the reserve pit or in tanks on location. These fluids would be disposed of at the collection facilities via subsurface injection or surface evaporative pits, or utilized for potential beneficial use (i.e. drilling operations).

As discussed under **Drilling Operations** in **Section 4.4.4.1**, the hydraulic fracturing process is currently regulated by the EPA, BLM, and WOGCC, and is currently being evaluated for adequacy by the EPA. Chapter 3, Section 45 of WOGCC Rules and Regulations requires each operator/owner and/or service company to provide detailed information on the base stimulation fluid source including any chemical additives, compounds, and concentrations or rates proposed to be mixed or injected in each stage of a well stimulation program. The stimulation fluid information will be provided to the WOGCC as an addendum to the APD, as part of a comprehensive drilling/completion/recompletion plan, or on a Sundry Notice (WOGCC 2014b). In April of 2015, the BLM released a new rule to regulate hydraulic fracturing on public and Indian lands (Federal Register 2015). The rule: (1) ensures the protection of groundwater supplies by requiring a validation of well integrity and strong cement barriers between the wellbore and

water zones through which the wellbore passes; (2) increases transparency by requiring companies to publicly disclose chemicals used in hydraulic fracturing; (3) provides higher standards for interim storage of recovered waste fluids from hydraulic fracturing; and (4) provides measures to lower the risk of cross-well contamination with chemicals and fluids used in the fracturing operation.

In April of 2012, the EPA issued final rules that include the first federal air quality standards for natural gas wells that are hydraulically fractured, along with requirements for several other sources of pollution in the oil and gas industry (EPA 2012a).

On November 12, 2013 the WOGCC adopted a rule change requiring groundwater quality testing of water sources within a 0.5-mile radius of a proposed gas well both before and after completion activities. Effective April 1, 2014, all operators are required to submit a groundwater baseline sampling, analysis, and monitoring plan with an APD. The groundwater monitoring program consists of initial baseline water sampling followed by a series of subsequent sampling events after setting the production casing or liner.

Completion and testing operations typically require approximately 10 to 20 days to perform, 2 to 30 personnel, and 1 to 20 vehicles on location. Approximately 4,000–12,000 bbls of water per well would be needed for completion and testing operations. Drilling and completion activities together would require 24,000–42,000 bbls of water per well. Assuming 600 wells per year were drilled, the annual water demand for the Proposed Action and the action alternatives would be between 1,856 ac-ft (14.3 million bbls) and 3,248 ac-ft (25.1 million bbls) (see **Section 4.4.4.1, Groundwater Removal**). The total water demand over the 15 years required for well drilling would be between 27,840 ac-ft (214.1 million bbls) and 48,720 ac-ft (375.9 million bbls).

### 2.2.7.3 Production Facilities

Production facilities on the well pad would typically include wellhead valves and piping, separation, dehydration, and metering equipment, oil and water production tanks, a methanol storage tank and pump, and telemetry equipment. Production equipment would be fueled by natural gas or electricity. Telemetry equipment is currently used or planned for use by most Operators to improve well evaluation and operational efficiency, and to minimize well visits. Production pits would not be used. Well-site compression would be utilized on an as-needed basis. Buried natural gas gathering lines would be installed to transport produced gas from new wells to the existing gas-gathering pipeline system.

The project may also include the development of an overhead electrical system to provide commercial power to portions of the field, as well as lower-voltage, buried power utilities to individual well pads. The overhead system is estimated to include approximately 36 miles of line.

### 2.2.7.4 Pipeline Facilities

The Operators would use existing natural gas transmission pipelines that serve the project area. Transmission pipelines are major lines used to transport oil and natural gas from producing fields to users within a state and across state or international boundaries. Operators are not responsible for the construction or operation of gas transmission lines, and the construction of new transmission lines is not included as a component of the CD-C project.

Sub-surface gathering pipelines would be installed to transport produced gas from the new wells to the gas gathering pipeline system. Gathering pipelines collect and move natural gas or petroleum short distances from wells to processing facilities or to transmission pipelines. The gas gathering lines would be located adjacent and parallel to well access roads where possible to minimize surface disturbance. New pipelines would cross federal surfaces in a route developed to minimize resource impacts.

Pipeline construction consists of trenching, pipe stringing, bending, welding, coating, lowering pipeline sections into the trench, and backfilling. In general, construction widths would be 50 to 75 feet when not adjacent to a road and 25 to 50 feet when adjacent to an existing or new road. Newly constructed pipelines would be hydrostatically tested to ensure structural integrity. Approximately 2,700 gallons of

water would be required to test one mile of four-inch pipeline. Hydrostatic test water would be disposed of as approved by the BLM and the state.

### **2.2.7.5 Compression, Gas Treatment, and Ancillary Facilities**

Because the existing compression infrastructure in the project area would not provide sufficient capacity to compress the additional gas volumes anticipated from the CD-C project, supplemental compression would be required at various locations throughout the project area. An estimated 24,936 horsepower (hp) of additional compression may be needed as the project is developed for dedicated compressor sites and at well sites. The additional compressor sites, including a large central pipeline compression facility and possibly some well-site compression, could add up to 60 acres of disturbance.

It is anticipated that one additional central gas-processing/stabilization facility would be needed within the project area, disturbing up to 30 acres.

### **2.2.7.6 Produced-Water Disposal**

Produced water from conventional natural gas production may be stored in tanks at the well site prior to transport by water-hauling trucks or transported in flowlines to collection facilities for disposal. All produced water disposal would be in accordance with applicable WOGCC and WDEQ requirements and approved under BLM Sundry Notice, as appropriate. An estimated 30 new injection wells and 20 produced water handling facilities would be constructed to dispose of produced water. Conventional wells in the project area average 18 bbls/day of produced water. Produced water, condensate, and gas would be separated at the well site or at central facilities. Depending on the method of disposal, permits are required from Wyoming Department of Environmental Quality—Water Quality Division (WDEQ–WQD) (surface) or WOGCC (subsurface) for disposal of produced water. This document does not analyze the surface discharge of produced water. If proposals for the surface discharge of produced water were submitted to the BLM, those proposals would be analyzed in a separate NEPA document.

CBM development differs from conventional gas production primarily in that CBM development requires the dewatering of coal seams prior to gas production. During initial depressurization, CBM wells are expected to produce 500 to 1,000 bbls/day of produced water, compared with 18 bbls/day for conventional wells within the CD-C. Dewatering of the coal seams would continue to occur throughout the production phase, with the greatest volumes of water being produced at the outset, and decreasing thereafter.

Produced water from CBM wells in the CD-C project area may be disposed of by reinjection or by evaporation from impoundments under the provisions of Onshore Order No. 7. Produced water could also be recycled or reused. Reinjection is typically the preferred method of disposal on federal lands; however, feasibility is dependent on the porosity and capacity of the receiving aquifers. General impacts associated with the handling and disposal of produced water are analyzed and disclosed in this document. As with conventional natural gas development, if a proposal for a site-specific CBM development project is received by the BLM, site-specific NEPA analysis would occur at that time.

### **2.2.7.7 Abandonment**

When production at a well site ceases, or in the case of a dry hole, the Operators would submit to the BLM a plan (to be approved in writing) for plugging and abandoning the well. Minimum standards for this plan are found in Onshore Oil and Gas Order No. 2, III.G. Any violation of the plugging orders is considered a major violation. All newly completed or recompleted wells in which oil or gas is not encountered in paying quantities shall be promptly plugged and abandoned (43 CFR 3162.3-4[a]). Per Onshore Order # 2 III.G.10, the Operator is required to cut off the casing at the base of the cellar or 3 feet below the final restored ground (whichever is deeper). The wellbore would then be covered with a metal plate at least ¼ inch thick and welded in place, or a 4-inch pipe 10 feet in length, 4 feet above ground and embedded in cement, as specified by the Authorized Officer. The well location and identity shall be

permanently inscribed and a weep hole shall be left if a metal plate is welded in place. All surface equipment would be removed from the site and the surface would be recontoured to its original appearance. Reclamation would occur as specified in either Appendix E or Appendix M, and in conformance with the stipulations attached to individual APDs and ROWs, the RFO RMP, and the BLM State Reclamation Policy.

### **2.2.7.8 Operator-Committed Practices**

During preliminary near-field air dispersion modeling analyses of CD-C project emissions it was apparent that the nitrogen dioxide concentration impacts were above the 1-hour nitrogen dioxide National Ambient Air Quality Standards (NAAQS) for modeling scenarios that included drill rig engines with Tier 0 emissions levels, and it was necessary to consider drill rig engines with at least Tier 2 emissions levels in order to demonstrate compliance with the 1-hour nitrogen dioxide NAAQS. Therefore the CD-C Operators committed to using a minimum of Tier 2 drill rig engines for drilling operations. This commitment will be included and become enforceable in the Record of Decision.

### **2.2.7.9 Management of Greater Sage-Grouse**

In February 2013, the USFWS published the Greater Sage-Grouse Conservation Objectives Final Report (the COT Report, USFWS 2013c). The report identified threats to the Greater Sage-Grouse throughout its range and conservation measures that would best address those threats in order to conserve the species. Although the COT Report recommended that impacts to all Sage-Grouse habitat be avoided, it also identified Priority Areas for Conservation (PACs) as “key areas across the landscape that are necessary to maintain redundant, representative, and resilient populations” of the species. The report describes maintaining the integrity of PACs as “the essential foundation for sage-grouse conservation.” The Wyoming portion of the Wyoming Basin Greater Sage-Grouse population is identified in the report as low risk given the size of the population; the presence of large, contiguous habitats; and regulatory measures providing habitat protection. However, energy development, infrastructure, improper grazing, and recreation are specifically identified in the COT Report as “present and widespread” threats to the Greater Sage-Grouse in the Wyoming portion of the Wyoming Basin.

On September 22, 2015 the USFWS made public the results of its 12-month finding on Greater Sage-Grouse (published in the Federal Register October 2, 2015). The USFWS concluded that the Greater Sage-Grouse does not warrant protection under the ESA and will not be listed at this time. The USFWS based its determination on the adoption of regulatory mechanisms by federal and state agencies that would implement the conservation measures recommended in the COT report to counter the risks to Greater Sage-Grouse and its habitat, especially PACs. The measures “have substantially reduced these risks in approximately 90 percent of the breeding habitat through avoidance and minimization measures.”

The regulatory mechanisms referred to in the USFWS finding consist of management tools developed by federal and state governments to protect Greater Sage-Grouse habitat throughout the range of the species. In Wyoming, those tools are contained in the State of Wyoming Greater Sage-Grouse Core Area Protection Strategy (SGEO) (SWEO 2015) and in a group of RMP amendments approved by the BLM in September 2015. In a series of Executive Orders beginning in 2008, the State of Wyoming designated critical Greater Sage-Grouse habitat in the state as Core Population Areas and laid out a number of conservation and protection measures to ensure maintenance of Sage-Grouse populations in those areas (SWEO 2015). The strategy was affirmed by BLM IM WY-2012-019, which guided management of Sage-Grouse habitat on federal lands and mineral estate until a BLM planning process could formalize the BLM’s own management tools for Greater Sage-Grouse habitat. That process was completed on the same date as the USFWS announcement—September 22, 2015—with the publication of the Record of Decision and Approved Resource Management Plan Amendments for Greater Sage-Grouse (ARMPA, BLM 2015b).

In Wyoming, the PACs described in the COT Report are the Core Areas identified in the Wyoming Core Area Protection Strategy (SGEO). Under the Wyoming ARMPA, Greater Sage-Grouse and its habitat on public lands within Core Areas will be managed using a suite of management tools that are similar to those of the SGEO. The ARMPA and the SGEO provide consistent habitat management across the range of the Greater Sage-Grouse, prioritize development outside of priority habitat, and require mitigation that provides a net conservation gain to the species within Core Areas. The BLM will implement actions to achieve the goal of net conservation gain that include compensatory mitigation as a strategy that should be used when avoidance and minimization measures are inadequate.

The ARMPA defines Priority Habitat Management Areas (PHMAs), which are Sage-Grouse habitats that have the highest conservation value for maintaining or increasing Sage-Grouse populations. PHMAs are generally synonymous with Core Areas described in the SGEO. The ARMPA also defines General Habitat Management Areas (GHMAs), which are occupied (seasonal or year-round) habitat outside of priority habitat. Within PHMAs, the ARMPA designates another management category for areas considered Greater Sage-Grouse “strongholds,” Sagebrush Focal Areas or SFAs (**Map 3.9-1**).

Management of Greater Sage-Grouse within the CD-C project area will conform to the ARMPA and the ROD for the Greater Sage-Grouse. The management tools described by the Core Area Conservation strategy and the ARMPA are in large part the same and they will apply to all Greater Sage-Grouse habitats within the CD-C project area on federal, private, and state lands under the Proposed Action and all alternatives, including the No Action Alternative. The major tools are summarized below. A complete description of the tools can be found in the ARMPA and the SGEO, available respectively at:

[https://eplanning.blm.gov/epl-front-office/projects/lup/9153/63189/68431/002\\_Wyoming\\_ARMPA\\_Main-Body.pdf](https://eplanning.blm.gov/epl-front-office/projects/lup/9153/63189/68431/002_Wyoming_ARMPA_Main-Body.pdf)

<http://www.wyfb.org/images%5CSGExecutiveOrder2015.pdf>

**No Surface Occupancy (NSO)** – Both the ARMPA and the SGEO contain year-round prohibitions on surface occupancy and surface-disturbing activities within 0.6 miles of leks in PHMAs (core areas) and within 0.25 miles of leks in GHMAs, measured from the perimeter of occupied or undetermined leks. Exceptions may be granted depending on site-specific factors.

**Timing Limitations** – The ARMPA and SGEO call for a prohibition of surface-disturbing and/or disruptive activities within PHMAs from April 15–June 30 to protect Sage-Grouse breeding, nesting, and early brood-rearing habitat. Outside PHMAs, surface-disturbing and/or disruptive activities will be prohibited from April 15–June 30 to protect Sage-Grouse nesting and early brood-rearing habitats within 2 miles of any occupied lek. The ARMPA provides for shifting the date by 14 days prior to or subsequent to the listed dates, where data support a different timeframe. Within the RFO, the dates are April 1–July 15 and the 2-mile buffer outside PHMAs is qualified by the addition of the phrase “or in identified greater sage grouse . . . nesting or brood-rearing habitat.”

Surface-disturbing and/or disruptive activities will also be prohibited from December 1–April 14 within mapped Greater Sage-Grouse winter concentration areas in PHMAs. The same timing limitation will be applied outside PHMAs when a winter concentration area supports wintering Greater Sage-Grouse that attend leks within a PHMA. Within the RFO, the dates are November 15–April 14. There are currently no mapped winter concentration areas within the CD-C project area.

A surface-disturbing activity is defined as, “an action that alters the vegetation, surface/near surface soil resources, and/or surface geologic features, beyond natural site conditions and on a scale that affects other Public Land values.” Disruptive activities are defined in the ARMPA as “actions other than those taken for human health and safety, regulatory compliance or emergency . . . if the activity would require people and/or the structure or activity to be present in these habitats for a duration of more than 1 hour during any one 24-hour period during the applicable season in the site-specific area.”

**Road Limitations** – New local or collector roads will be avoided within 1.9 miles of the perimeter of occupied sage-grouse leks within PHMAs. All new roads will be prohibited within 0.6 miles of the perimeter of occupied sage-grouse leks within PHMAs.

**Density and Disturbance Limitations** – Within PHMAs (core only), the density of disturbance of an energy or mining facility will be limited to an average of one site per square mile (640 acres) within the area considered in the Density/Disturbance Calculation Tool (DDCT), subject to valid existing rights. The proposed location and cumulative existing disturbances should not exceed 5 percent of suitable habitat of the DDCT area. No such analysis is required in GHMAs as the thresholds do not apply there. The DDCT process is explained in detail on its web site: <https://ddct.wygisc.org>.

**Required Design Features (RDFs)** – The ARMPA provides numerous RDFs (included in this FEIS in **Appendix C, Conservation and Mitigation Measures**). These are to be used in PHMAs when applicable and appropriate after project-level location and design are known. Examples of RDFs that could be applied to oil and gas development activities in CD-C include but are not limited to the following:

- Remove or modify existing power lines.
- Reclaim unused rights-of-way.
- Locate man-camps outside of PHMAs.
- Design roads to the minimum standard appropriate for the intended use and designate newly constructed routes for authorized use only.
- Cluster disturbances, operations, and facilities.
- Use directional and horizontal drilling to the extent feasible.
- Use remote monitoring techniques for production facilities to reduce vehicle use.
- Use only closed-loop systems for drilling operations, with no drilling pits.
- Limit noise to less than 10 decibels above ambient at sunrise at the perimeter of a lek during the active lek season.
- Ensure habitat restoration to meet Sage-Grouse habitat needs in reclamation practices/sites.

**Noise** – New project noise levels, either individual or cumulative, should not exceed 10 dBA (as measured by L50 [i.e. 50 percent of the time]) above baseline noise at the perimeter of the lek from 6:00 pm to 8:00 am during the breeding season (April 1–May 15).

**Onsite and Offsite Mitigation** – When authorizing third-party actions within PHMAs that result in habitat loss and degradation, the BLM will require “mitigation that provides a net conservation gain to the species including accounting for any uncertainty associated with the effectiveness of such mitigation.” The net gain will be achieved by avoiding, minimizing, and compensating for impacts. The actions to achieve the goal of net conservation gain will be consistent with the Wyoming Core Area Strategy (EO 2015-4) that includes “compensatory mitigation as a strategy that should be used when avoidance and minimization are inadequate to protect Core Population Area Greater Sage-Grouse.”

### 2.3 ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED STUDY

Three alternatives were considered and eliminated from detailed study. The alternatives and the reasons for eliminating them are described below.

#### 2.3.1 Surface Disturbance Cap with Reclamation Credits and Debits

This alternative would place a 30-acre cap on the amount of future surface disturbance in a section of public land. If previous natural gas development had disturbed the surface in a section, the acreage that had been successfully reclaimed would be added to the 30 acres. If the disturbance had not been

successfully reclaimed, the acreage would be subtracted from 30 acres. The aim is to provide additional incentive for successful reclamation and increased disincentive for slow or failed reclamation. For example, in a section in which 10 acres of surface disturbance had occurred and 6 acres had been reclaimed, the cap would be modified according to the success or failure of the reclamation on those 6 acres. (The 4 acres used for roads and on-pad facilities would not count one way or the other toward credits or debits, but would count against the cap.) If the 6 acres met the criteria for successful reclamation, the modified cap for that section would be 30 acres plus the 6 acres of reclaimed surface, a total cap of 36 acres (of which 4 had been used for roads and on-pad facilities, leaving 32 acres that could still be utilized). If, on the other hand, the 6 acres did not satisfy the criteria, the modified cap would be 24 acres—the 30-acre base less the 6 acres of unsuccessful reclamation (4 of which were already impacted, leaving 20 acres for future development). If half the reclamation met the criteria and half did not, the 30-acre cap would remain unchanged, as the failed 3 acres would offset the successful 3 acres, leaving the cap at 30 acres with 4 of those acres encumbered.

After closely considering this alternative, the BLM determined its actual operation would be unpredictable and that neither the BLM nor the Operators could rely on its results. In certain instances, the formulation could yield a cap in one section of perhaps 90 acres and in an adjacent section of minus 30 acres. The complexity of the alternative and the uncertainty of its results make it difficult to describe and there is a high likelihood that the result would be contention between the BLM and the Operators over the meaning of and the operation of the cap. Because of the complexity and the uncertainty about its effects, and because Alternative C already satisfied all the criteria for a surface disturbance cap, the BLM decided that the Surface Disturbance Cap with Reclamation Credits and Debits would not be carried forward for analysis in the EIS.

### 2.3.2 Focused Development

The Focused Development Alternative would include the same degree of overall natural gas development as the Proposed Action, but the drilling would be phased geographically, focusing first on one defined area and then moving to another area following completion of development in the initial area. The purpose of the geographical phasing would be to allow large areas of wildlife habitat to remain undisturbed for an extended period, during which time other areas would undergo intense and continuous development. Several alternatives with this general formulation were considered during discussions between the Operators and the CD-C cooperating agencies between 2005 and 2009. The BLM was not a participant in those discussions. Discussions were aimed at identifying larger tracts of habitat that could remain undeveloped for a considerable period of time and other areas—areas of focused development—that would be completely developed during that same period. In exchange for agreeing to delay developing in one area, the Operators would receive exemption from seasonal wildlife stipulations on public lands in the area of focused development. Upon completion of development in the initial focus area, that area would in turn have no activity and development would shift to the previously undeveloped area.

The concept of focused development has two key elements: (1) that the leaseholders, property owners, Operators, and others with an interest in the production of oil and gas in both the area of focused development and those in the area of delayed development be the same or at least have a shared interest, since all the parties would have to participate if the concept were to be effective; and (2) that the BLM would be able to exempt the federal oil and gas leaseholders from the seasonal wildlife stipulations. After considerable examination, it was determined that neither of the key elements could be provided and the participants in the discussion concluded that such an alternative could not be properly designed and implemented.

In the case of developing a shared interest among those interested in developing the fluid mineral estate, the sheer number of interests (over 60 different leaseholders within the project area and over 20 different operators), and the diversity and complexity of their holdings presented legal, planning, and logistical

problems that could not be overcome. Additionally, the substantial portion of the project area that is within the checkerboard would require participation by private property owners, many of whom are not federal leaseholders.

The creation of an oil and gas *unit* is one method of creating a shared interest among various parties. A unit agreement allows exploration and development of properties owned by multiple parties to proceed with a program paced to develop all lands within the unit, regardless of ownership boundaries. Unitizing the CD-C project area to create a shared interest would not work because: (1) The leaseholders, property owners, operators, and operating rights owners over such a wide geographical area—the whole project area or a large part of it—do not have sufficient interests in common for a single exploratory unit to be formed; (2) Developing exploration units requires certain levels of obligation to drill wells. Under the *Yates* decision, if the drilling is successful and yields a producing well, all leases covered by the unit are considered *held* by production (*Yates Petroleum Corp. et al.*, 67 IBLA 246, 1982). Holding hundreds of thousands of leasehold acreage without development is not in the best interest of the BLM as the federal lessor; and (3) Leases are offered and granted with certain time terms, during which leaseholders and Operators are obligated to develop the leases or the leases will expire. If a CD-C project unit were to form, then hundreds of thousands of leased acres could be held by production from only a few wells and the owners of these leases likely would not receive the returns needed to pay out the cost of acquiring the leases. This in turn could result in the operator not being able to drill and produce at adequate levels to meet their income requirements or returns on investment. This would be a major impact to stockholder value and the development of U.S. energy.

It was also determined that exempting the leaseholders from seasonal wildlife stipulations could not be done. The BLM reviewed the federal laws and regulations that govern the management of habitat of species protected under the ESA and those that were designated as Special Status by the BLM and concluded it could not agree to the necessary blanket exemptions, over such a large area, for such an extended period of time.

### 2.3.3 Alternative A: 100-Percent Vertical Drilling

Alternative A analyzed the potential that all 8,950 wells would be drilled from individual single-well well pads and that no directional drilling would occur. This was considered necessary because the Operators' proposal contained no commitment on the part of individual operators or the group as a whole to implement directional drilling. An examination of the disturbance estimates submitted as part of the Operators' Project Description indicates that approximately 42 percent of the 8,950 wells to be drilled would be located on multiple-well pads and drilled to the target formation directionally; the other 58 percent would be located on single-well pads and drilled vertically. However, because the proposal contains no commitment to implement any amount of directional drilling, the BLM determined that the possibility of no directional drilling should be examined.

In order to examine the possibility that all 8,950 wells would be drilled from single-well well pads, the BLM developed Alternative A, with 100-percent vertical drilling. All other elements of the CD-C project would have remained as described in the Proposed Action and Features Common to All Alternatives. With the assumption of 100-percent vertical drilling, the estimated surface disturbance would have been increased by 31 percent over the Proposed Action, from a Proposed Action total of 47,200 acres to 61,696 acres.

This alternative was dropped from further consideration in the Final EIS because comments on the Draft EIS raised considerable concerns regarding the amount of surface disturbance that would result from this alternative. In addition, this alternative did not resolve resource conflicts identified during scoping and the DEIS comment period. Therefore, it has been dropped from further consideration.

## 2.4 COMPARISON OF ALTERNATIVES

Table 2.4-1. CD-C surface disturbance – historic, Proposed Action and Alternatives (acres)

Category	SURFACE DISTURBANCE						
	Oil and Gas			Grand Total <sup>2</sup>	Percent of Project Area	Change from Proposed Action	
	Well Pads (incl. roads)	Related Facilities <sup>1</sup>	Total			acres	%
Historical							
Initial	20,524	28,694	49,218	60,176	5.6%	—	—
Long-term	6,403	2,069	8,472	17,663	1.7%	—	—
Proposed Action							
Initial	41,889	5,311	47,200	47,200	4.4%	—	—
Long-term	17,998	863	18,861	18,861	1.8%	—	—
Combined IN <sup>3</sup>	62,413	34,005	96,418	107,376	10.0%	—	—
Combined LT <sup>3</sup>	24,401	2,932	27,333	36,524	3.4%	—	—
Alternative B: Enhanced Resource Protection Alternative							
Initial	40,205	5,311	45,516	45,516	4.3%	-1,684	-3.6%
Long-term	17,386	863	18,249	18,249	1.7%	-611	-3.2%
Combined IN <sup>3</sup>	60,729	34,005	94,734	105,692	9.9%	-1,684	-1.6%
Combined LT <sup>3</sup>	23,789	2,932	26,721	35,912	3.4%	-611	-1.7%
Alternative C: Cap on Surface Disturbance, 60 Acres and 30 Acres per Section							
Initial	37,644	5,311	42,955	42,955	4.0%	-4,245	-9.0%
Long-term	16,455	863	17,318	17,318	1.6%	-1,543	-8.2%
Combined IN <sup>3</sup>	58,168	34,005	92,173	103,131	9.6%	-4,245	-4.0%
Combined LT <sup>3</sup>	22,858	2,932	25,790	34,981	3.3%	-1,543	-4.2%
Alternative D: Directional Drilling							
Initial	28,347	5,311	33,658	33,658	3.1%	-13,541	-28.7%
Long-term	12,748	863	13,611	13,611	1.3%	-5,250	-27.8%
Combined IN <sup>3</sup>	48,871	34,005	82,876	93,834	8.8%	-13,541	-12.6%
Combined LT <sup>3</sup>	19,151	2,932	22,083	31,274	2.9%	-5,250	-14.4%
Alternative E: No Action <sup>4</sup>							
Initial	19,028	2,411	21,440	21,440	2.0%	-25,760	-54.6%
Long-term	8,175	392	8,567	8,567	0.8%	-10,293	-54.6%
Combined IN <sup>3</sup>	39,552	31,105	70,658	81,616	7.6%	-25,760	-24.0%
Combined LT <sup>3</sup>	14,578	2,461	17,039	26,230	2.5%	-10,293	-28.2%
Alternative F: Agency Preferred Alternative							
Initial	38,497	5,311	43,808	43,808	4.1%	-3,391	-7.2%
Long-term	16,765	863	17,628	17,628	1.6%	-1,232	-6.5%
Combined IN <sup>3</sup>	59,021	34,005	93,026	103,984	9.7%	-3,391	-3.2%
Combined LT <sup>3</sup>	23,168	2,932	26,100	35,291	3.3%	-1,232	-3.4%

<sup>1</sup> Includes utilities such as gas, condensate, and water collection pipelines; buried power line facilities; water management facilities; and compressor facilities. Unchanged under each alternative, except for No Action, which has 45.4% of the Proposed Action figure.

<sup>2</sup> Includes 10,958 acres of non-oil and gas disturbance for the historical totals and the *Combined IN* and *Combined LT* totals.

<sup>3</sup> *Combined IN* equals the sum of historical initial disturbance and future initial disturbance. [Historical long-term disturbance has not been reclaimed; future initial disturbance has not yet occurred.]

*Combined LT* equals the sum of historical long-term disturbance and future long-term disturbance.

<sup>4</sup> *Initial* and *Long-term* acreage disturbance estimates are based on the percentage of the CD-C project area mineral estate that is private and state, 45.4 percent of the total.

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative**

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>PHYSICAL ENVIRONMENT</b>						
<b>Geology</b>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>
	The intensity of impacts on geologic resources would vary in relation to the surface disturbance by alternative but would be low in all cases, providing that the Operators adhere to the measures in <b>Appendix C</b> and the Wyoming DEQ and WOGCC requirements. Impacts would not be significant under any alternative.					
<b>Paleontology</b>	<i>Medium impact</i>	<i>Medium impact</i>	<i>Medium impact</i>	<i>Medium impact</i>	<i>Low impact</i>	<i>Medium impact</i>
	Implementation of the <b>Proposed Action</b> or <b>any of the alternatives</b> may adversely impact paleontological resources by destroying or damaging them and making them unavailable for scientific inquiry, to the extent that the ground is disturbed by development activities. Disturbance could also be beneficial by resulting in the discovery and preservation of fossils that add to scientific knowledge. Pre-disturbance surveys and disturbance mitigation, described in <b>Appendix C</b> and <b>Appendix D</b> , would minimize adverse impacts. The impact significance criterion would not be exceeded.					
<b>Soils</b>	<i>High Impact</i>	<i>High Impact</i>	<i>Medium Impact</i>	<i>Medium Impact</i>	<i>Low Impact</i>	<i>High Impact</i>
	The types of impacts would be similar for the <b>Proposed Action</b> and <b>all alternatives</b> . The risk of adverse impacts would be diminished to the degree that an alternative reduces disturbance. Measures in <b>Alternative B</b> (expanded avoidance zone in the Muddy Creek drainage), <b>Alternative C</b> (disturbance caps), <b>Alternative D</b> (limitation of one well pad per section), and <b>Alternative F</b> (limitation of eight well pads per section) would reduce adverse impacts produced by surface disturbance. Impacts under <b>Alternative E</b> would be greatly decreased because development on public lands would be much less. Successful implementation of required mitigation measures and BMPs would insure that the significance criteria would not be exceeded.					
<b>Water Resources: Surface Water</b>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>
	Under the <b>Proposed Action</b> and <b>all alternatives</b> , surface water impacts could include contamination of surface water from the authorized or accidental discharge of fluids and produced water and the impacts (including sediment loading) from surface disturbance related to the construction of facilities. The degree of impact is related directly to the amount of initial surface disturbance, which is highest for the <b>Proposed Action</b> and less for the <b>alternatives</b> . Measures in <b>Alternative B</b> (expanded avoidance zone in the Muddy Creek drainage), <b>Alternative C</b> (disturbance caps), <b>Alternative D</b> (limitation on well pads per section), and <b>Alternative F</b> (limitation of eight well pads per section) would reduce adverse impacts produced by surface disturbance. Four of the alternatives would exceed at least one of the 8 significance criteria. <b>Alternative E</b> and <b>Alternative F</b> would not exceed any significance criteria.					

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, continued**

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>PHYSICAL ENVIRONMENT, continued</b>						
<b>Water Resources: Groundwater</b>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>
	Significant impacts to groundwater are not expected under the <b>Proposed Action or the alternatives</b> because the formations targeted for gas development and produced water disposal are stratigraphically isolated from aquifers that host springs and flowing wells used for stock and domestic purposes, because of state-of-the-art construction techniques, and because of implementation of protective measures in <b>Appendix C</b> and in the Wyoming DEQ and WOGCC requirements.					
<b>Air Quality<sup>4</sup></b>	<p><b>National Ambient Air Quality Standards (NAAQS), Wyoming Ambient Air Quality Standards (WAAQS), and PSD Increments</b> — Air pollutant concentrations affected by emissions associated with the <b>Proposed Action</b> and all <b>alternatives</b> would be in compliance with the standards and would not exceed the increments. Ozone concentrations could exceed the level of the NAAQS during a single year; however, the modeled 2-year average of maximum 8-hour concentrations indicated that ozone concentrations would be in compliance with the NAAQS, which is based on a 3-year average. Maximum 1-hour NO<sub>2</sub> impacts from drilling-related activities could exceed the 1-hour standards during years when drilling occurs; however, given that these impacts are maximum yearly values, they would not result in a violation of the NAAQS or WAAQS since the standards are based on a 3-year average and drilling would not occur at the same location for a 3-year duration.</p> <p><b>Air Quality Related Values (AQRVs)</b> — The visibility analysis indicated a maximum of 5 days (for <b>action alternatives</b>) with project emissions resulting in impacts greater than the 0.5 delta deciview (<math>\Delta dv</math>) threshold at any of the Class I and sensitive Class II areas; using the 98<sup>th</sup> percentile value as a threshold, there are zero days above the 0.5 <math>\Delta dv</math> threshold. For the <b>No Action</b> Alternative there would be no days that are above the 0.5 <math>\Delta dv</math> threshold.</p> <p>Maximum nitrogen deposition impacts could exceed the deposition analysis threshold of 0.005 kilograms/hectare/year (kg/ha/yr) at the Mount Zirkel, Rawah, Savage Run, and Flat Tops Class I Wilderness Areas; at Class I Rocky Mountain National Park; and at the Dinosaur National Monument Class II area. There would be no sulfur deposition impacts that exceed the deposition analysis threshold at any Class I or sensitive Class II area. In addition there would be no impacts to sensitive lakes that exceed threshold values.</p> <p><b>Compliance/Mitigation</b> — All BLM-approved energy development projects would comply with applicable air quality regulations and standards, as determined by the WDEQ. Mitigation measures determined to be necessary to demonstrate compliance with the applicable NAAQS and WAAQS and to prevent significant impacts to visibility impairment and nitrogen deposition will be a required condition in the ROD.</p>					

<sup>4</sup> The Air Quality impacts are not characterized by alternative because the impacts cannot be described on a spectrum from low to high and because the analysis is too complex to be characterized in a brief format.

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, *continued***

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>BIOLOGICAL ENVIRONMENT</b>						
<b>Vegetation and Invasive, Non-Native Plant Species</b>	<i>Medium to High Impact</i>	<i>Medium Impact</i>	<i>Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Medium Impact</i>
	<p>Historical disturbance equivalent to 5.6% of the project area's surface has already occurred. Additional disturbance would increase both short-term loss of <b>vegetation</b> and the area that would remain unvegetated during the production period—45–55 years. It would also increase the spread of <b>invasive species</b> throughout the project area. The <b>Proposed Action</b> would increase surface disturbance by 4.4%, a <i>Medium to High</i> impact depending on the success of reclamation. The alternatives would all decrease the degree of impact by reducing surface disturbance, by reducing the number of disturbance sites, and/or by improving the likelihood of reclamation success. <b>Alternative B</b> would reduce disturbance by 3.6%, would reduce the number of disturbance sites by 5.4%, and would improve the likelihood of reclamation success in certain habitats, diminishing the degree of overall impact to <i>Medium</i>. <b>Alternative C</b> would reduce disturbance by 9.0% and the number of disturbance sites by 13.5%, and would improve the likelihood of reclamation success on public lands, diminishing the degree of overall impact to <i>Medium</i>. Although it provides no specific measure to address reclamation success, <b>Alternative D</b> would strongly reduce disturbance, by 28.7%, and the number of disturbance sites, by 39.1%, diminishing the degree of overall impact to <i>Low to Medium</i>. With little or no new disturbance on public lands, <b>Alternative E</b> would reduce both disturbance and the number of disturbance sites by 54.6%, diminishing the degree of overall impact to <i>Low to Medium</i>. <b>Alternative F</b> would reduce disturbance by 7.2% and the number of disturbance sites by 10.8%. Combined with measures that would improve the likelihood of reclamation success, the reduction would diminish the degree of overall impact to <i>Medium</i>.</p>					
<b>Terrestrial Wildlife</b>	<p>Impacts would include loss of forage, as well as direct and indirect loss of habitat. Significant impact can be reached by actions that result in disruption or irreplaceable loss of vital and high-value habitats such as CWR and migration corridors, resulting in impacts that exceed the WGFD's <i>High</i> or <i>Extreme</i> impact definitions. Disturbance of big game CWR would be in addition to historical disturbance of 10.3% of pronghorn CWR and 5.4% of mule deer CWR. Big game species in the area are expected to be significantly affected by the <b>Proposed Action</b> and the <b>alternatives</b>. Other species (raptors, small mammals, and songbirds) should be protected sufficiently by the COAs, RMP requirements, and BMPs to avoid exceeding the significance level under the <b>Proposed Action</b> and the <b>action alternatives</b>. Those terrestrial wildlife species that have potential impacts from the <b>Proposed Action</b> or <b>any of the alternatives</b> approaching or reaching the level of significance are identified below.</p>					
<b>Pronghorn<sup>5</sup></b>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>
<b>Mule Deer<sup>9</sup></b>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>	<i>Significant Impact</i>

<sup>5</sup> The Significant Impact shown for the Proposed Action and all alternatives for Pronghorn and Mule Deer is equivalent to the WGFD (2010) definition of *High* or *Extreme*.

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, continued**

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>BIOLOGICAL ENVIRONMENT, continued</b>						
<b>Aquatic Wildlife</b>	<i>Medium impact</i>	<i>Low impact</i>	<i>Medium impact</i>	<i>Medium impact</i>	<i>Low impact</i>	<i>Low impact</i>
	For the <b>Proposed Action</b> and <b>all alternatives</b> , impacts to aquatic wildlife are primarily associated with increased sediment entering aquatic habitats from ground-disturbing activities and road building adjacent to or crossing aquatic habitat, but significant effects are not expected. <b>Alternative B</b> (protections for the Muddy Creek and Bitter Creek watersheds and the Chain Lakes wetlands and playas) and <b>Alternative F</b> (surface use Conditions of Approval in ½-mile buffer around Muddy Creek and Bitter Creek and in a ¼-mile buffer around playas in the Chain Lakes WHMA) have measures that would diminish impacts on aquatic wildlife.					
<b>Special Status Wildlife</b>	Only those Special Status wildlife species that have potential impacts from the <b>Proposed Action</b> or <b>any of the alternatives</b> approaching or reaching the level of significance are identified below.					
<b>Sage-Grouse (Overall)</b>	Although there may be localized loss of habitat at the site-specific scale, by implementing the requirements of the ARMPA and the SGEO (2015) the BLM would be reducing impacts to Greater Sage-Grouse by covering all lands in the state with a single regulatory framework in the most important habitats in the Wyoming basin population.					
<b>Sage-Grouse (PHMA)</b>	Impacts on Greater Sage-Grouse within the PHMA, about 15 percent of the project area, are expected to be low and to support the goal of net conservation gain under the Proposed Action or any of the alternatives. However, some portions of the PHMA within the project area have existing disturbance that may exceed the distance and disturbance thresholds of the ARMPA and the SGEO. As site-specific projects are proposed within this area, the DDCT analysis tool may demonstrate exceedances. The BLM would work with the project proponents to avoid, reduce, and mitigate adverse impacts to the extent compatible with lessees' rights to drill. In some cases, off-site compensatory mitigation may be required.					
<b>Sage-Grouse (GHMA)</b>	In the GHMA, which makes up 85 percent of the project area, the 0.25-mile surface occupancy buffer and the 2-mile buffer for seasonal limitation on disturbance would provide a base level of habitat and population protection. Local impacts would be Low to Extreme depending on the amount of existing development and the degree of new development in an area. In the high-density portions of the CD-C gas field (44 percent of the project area), there is an average of 5 wells per section. New development would likely meet the WGFD criteria for High or Extreme impact (WGFD 2010a) at the site-specific level. In the low-density portions of the CD-C gas field (56 percent of the area), the average wells per section is 0.7. New development in those areas would likely meet the criteria for Low—or at most Moderate—impact because of the Greater Sage-Grouse distance and timing limitations and the application of the conservation and protection measures found in <b>Appendix C</b> . Types of impacts would be similar under the Proposed Action or any of the alternatives but each of the alternatives would reduce overall surface disturbance, especially <b>Alternatives D and E</b> .					
<b>Endangered Fish</b>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>
	Impacts to the four Endangered fish species found downstream of the project area are not expected to occur under any alternative, except for water depletion. The biological opinion of the USFWS ( <b>Appendix Q2</b> ) concludes that the CD-C project "is not likely to jeopardize the continued existence of endangered fish and is not likely to destroy or adversely modify designated critical habitat." The biological opinion requires payment of a depletion fee by the Operators based on an annual project depletion of 650 acre-feet.					

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, continued**

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
BIOLOGICAL ENVIRONMENT, continued						
Sensitive Fish	Significant Impact	Medium Impact	Significant Impact	Medium Impact	Low Impact	Medium Impact
	Sensitive fish species are found primarily in the Muddy Creek drainage where <b>Alternative B</b> and <b>Alternative F</b> have measures that would diminish impacts on aquatic wildlife. <b>Alternative D</b> and <b>Alternative E</b> would reduce overall surface disturbance and thus the impact on sensitive fish species..					
Special Status Plants	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact
	Potential impacts to Ute ladies'-tresses are not expected because suitable habitat is not known to occur within the CD-C project area and the likelihood of occurrence within the project area is low. Measures aimed at avoiding and protecting BLM sensitive plants that would be implemented under the <b>Proposed Action</b> and <b>all action alternatives</b> would insure that they would be little affected directly. To the extent that surface disturbance decreases and the number of disturbance sites is reduced, the likelihood of adverse impact is diminished further.					
Wild Horses	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact
	For the Proposed Action and all alternatives, long-term loss of forage is estimated at less than 0.1 percent of the total forage for both the Lost Creek HMA and the Adobe Town HMA. None of the impacts on wild horses would be of a magnitude that would exceed any of the three significance criteria. Available forage, water, and other habitat components would remain sufficient to achieve or maintain the Appropriate Management Level in each HMA; the viability of wild horse populations would be maintained; and the wild, free-roaming character of a wild horse herd in an HMA would not be lost.					
HUMAN ENVIRONMENT						
Lands with Wilderness Characteristics	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
	There are no Lands With Wilderness Characteristics within the CD-C project area.					
Visual Resources	Medium Impact	Medium Impact	Medium Impact	Low to Medium Impact	Low Impact	Medium Impact
	Under the <b>Proposed Action</b> and <b>all action alternatives</b> , adequate visual mitigation in the form of BMPs and COAs would allow oil and gas development to be compatible with the management objectives for Visual Resource Management Class III landscapes in the project area by partially retaining the existing character of the landscape. Development would be compatible per se with VRM Class IV objectives because VRM Class IV is meant to allow for major modification of the existing character of the landscape. <b>Alternative E, No Action</b> , would decrease the potential for visual impacts.					

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, continued**

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>HUMAN ENVIRONMENT, continued</b>						
<b>Recreation</b>	<i>Medium Impact</i>	<i>Medium Impact</i>	<i>Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low Impact</i>	<i>Medium Impact</i>
	Under the <b>Proposed Action</b> , the RFO would be able to meet its management objective for recreation because the project area is within the RFO's Western Extensive Recreation Management Area, where restriction or avoidance of surface-disturbing and disruptive activities to protect recreation is not required by the Rawlins RMP. The intensity of impacts to recreation under the alternatives would correlate to the variation in long-term surface disturbance by alternative with <b>Alternatives B, C, D, and F</b> producing less impact, and <b>Alternative E</b> much less impact.					
<b>Cultural and Historical Resources</b>	<i>Low to Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low to Medium Impact</i>
	Pre-disturbance surveys and avoidance would minimize adverse impacts and remove the potential for significant impacts for the <b>Proposed Action</b> and the <b>alternatives</b> . The numbers of sites that might be affected (and the number potentially eligible for the National Register of Historic Places) are as follows: <b>Proposed Action</b> , 1,416 (312); <b>Alternative B</b> , 1,365 (300); <b>Alternative C</b> , 1,289 (284); <b>Alternative D</b> , 1,010 (222); <b>Alternative E</b> , 643 (142); and <b>Alternative F</b> , 1,314 (289).					
<b>Socioeconomics</b>	Medium to High Impact	Medium to High Impact	Medium to High Impact	Medium to High Impact	Low to Medium Impact <sup>1</sup>	Medium to High Impact
	The <b>Proposed Action</b> and <b>Alternatives B, C, and F</b> would generate similar types of effects but with minor differences in scale. Estimated total project-related employment (direct, indirect, and induced jobs) would climb to a peak of around 4,000 jobs in Year 14, in addition to existing project employment. Following the completion of new well development, employment effects would continue during production, but at a substantially lower level, and decrease over time. As compared to the peak employment during development, regional employment would decrease by over 4,300 jobs, including both new and existing jobs following the completion of production. Population changes would closely follow employment gains and losses, peaking at about 3,700 new residents and almost 1,000 temporary workers during Year 15 of development and falling to about 700 residents by Year 20. Most community infrastructure such as water, wastewater, and solid waste disposal systems presently have adequate capacity to accommodate the added population, although some systems may require expansion during the latter part of the 15-year development cycle. Demand for community facilities would substantially diminish after development is completed. Substantial government revenues would be generated by the natural gas production—about \$3.8 billion in federal royalties, an estimated \$530 million in state mineral royalties, and \$3.1 billion in ad valorem and gross products taxes. With a reduced number of wells drilled on federal minerals, <b>Alternative D</b> would generate similar effects but with a substantially lower intensity, perhaps 12 percent less in most categories. Future federal mineral royalties would be reduced by 20 percent. Under <b>Alternative E, No Action</b> , drilling rates would be reduced by 55 percent with an equivalent reduction in the effects described for the Proposed Action.					

<sup>1</sup> Impact level dependent on the number of wells on federal minerals approved on a case-by-case basis.

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, *continued***

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>HUMAN ENVIRONMENT, continued</b>						
<b>Transportation</b>	Low to Medium Impact	Low to Medium Impact	Low to Medium Impact	Low to Medium Impact	Low Impact	Low to Medium Impact
	Each alternative would generate traffic associated with drilling and production activities. Based on the specified development assumptions, traffic patterns would be similar for all alternatives. Traffic increases would be substantially lower for <b>Alternative E (No Action)</b> compared to all other alternatives. For the <b>Proposed Action</b> and <b>Alternatives B, C, and F</b> , minor differences in the anticipated magnitude of annual average daily traffic (AADT) increases on affected highways and roads would result from differences in the ratio of the number of directional wells drilled on multi-well pads to the number of wells drilled on single-well pads. <b>Alternative D</b> differences would also result from the fewer number of total wells drilled. Estimated long-term production-related AADT is the same for the <b>Proposed Action and Alternatives B, C and F</b> (1,360) and would be reduced by 12 percent for <b>Alternative D</b> and 55 percent for <b>Alternative E</b> .					
<b>Noise</b>	<i>High Impact</i>	<i>High Impact</i>	<i>Medium Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Medium Impact</i>
	The <b>Proposed Action</b> and <b>alternatives</b> would generate similar types of noise from construction and operations, including traffic-related noise. The volume of noise would generally be directly related to the number of well pads for each alternative, as follows: <b>Proposed Action</b> , 6,126; <b>Alternative B</b> , 5,798; <b>Alternative C</b> , 5,299; <b>Alternative D</b> , 3,728; <b>Alternative E</b> , 2,783; and <b>Alternative F</b> , 5,465.					

## CHAPTER 2—THE PROPOSED ACTION AND ALTERNATIVES

**Table 2.4-2. Comparison of impacts by alternative, *continued***

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
<b>MANAGEMENT ENVIRONMENT</b>						
<b>Range Resources</b>	<i>Medium to High Impact</i>	<i>Medium to High Impact</i>	<i>Medium to High Impact</i>	<i>Low to Medium Impact</i>	<i>Low Impact</i>	<i>Medium Impact</i>
	Estimated long-term forage loss (Animal Unit Month [AUM] equivalent) by alternative is as follows: <b>Proposed Action</b> , 2,193 AUMs; <b>Alternative B</b> , 2,122 AUMs; <b>Alternative C</b> , 2,014 AUMs; <b>Alternative D</b> , 1,583 AUMs; <b>Alternative E</b> , 996 AUMs; and <b>Alternative F</b> , 2,053 AUMs. The number of allotments at risk of exceeding RMP significance criteria (10% permanent decrease in AUMs) would be highest under the Proposed Action, at 2-9 allotments.					
<b>Oil and Gas and Other Minerals</b>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>	<i>Low Impact</i>
	Under the <b>Proposed Action</b> and <b>Alternatives B, C, and F</b> , the fluid mineral resources of the CD-C project area would be developed fully—12.0 Tcf of natural gas and 167.3 million bbls of liquids—in the context of known reserves and current extraction technologies. Under <b>Alternative D</b> , it is postulated that development of federal minerals would be reduced by 20 percent, causing an 11.8-percent decrease in the production of fluid mineral resources. Under <b>Alternative E</b> , very little new natural gas resources would be produced from the federal mineral estate, dropping natural gas production from 12.0 Tcf to 5.5 Tcf and liquids from 167.3 million bbls to 75.9.					
<b>Health and Safety</b>	<i>High Impact</i>	<i>High Impact</i>	<i>Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low Impact</i>	<i>Medium Impact</i>
	The <b>Proposed Action</b> and <b>all alternatives</b> would result in similar impacts to the public and site workers, including increased risk of vehicle collisions on interstate highways and local road systems.					
<b>Waste and Hazardous Materials</b>	<i>High Impact</i>	<i>High Impact</i>	<i>Medium Impact</i>	<i>Low to Medium Impact</i>	<i>Low Impact</i>	<i>Medium Impact</i>
	Currently authorized actions are already exerting stress on permitted disposal facilities proximal to the project area. Authorization of the <b>Proposed Action</b> and <b>all alternatives</b> would result in further stress to the capacity of permitted waste management units, including those used for management of solid waste, produced water, and drilling mud. To the extent that alternatives increased directional drilling ( <b>C, D, and F</b> ) and/or reduced the total amount of drilling ( <b>D and E</b> ), that stress would be reduced and could work to extend the life of some existing disposal facilities.					